Introduction
The University of Illinois at Urbana-Champaign is committed to implementing the very latest in audio video (AV) communication capabilities, and supporting their use. Therefore, facility design criteria should support the latest and most appropriate in audio video communication. Audio video applications should be considered in the very beginning of the planning process during the pre-design phases.

AV Designer Requirements
New construction and major remodeling or renovation projects with audio-visual scope will require the services of an audio-visual consultant/designer. Minimum qualifications for the AV consultant are:

1. Designer firm must have AVIXA APEX Designation;
2. Designer must have an AVIXA CTS-D certification in good standing.
3. Six (6) years working experience in the audio-visual industry;
4. Documented and verified design and project experience with like projects and technologies as the University project being contracted;
5. Ability to develop and author detailed specifications, and other project documents described in these facility standards related to AV;
6. Ability to prepare detailed construction drawings;
7. Ability to inspect, evaluate, and report on various project deliverables both in the field and written submittals;
8. Experience in a campus environment.

Technology Services-CCME must review and approve any variance requests of these designer qualification requirements.

Third Party Commissioning
New construction and major remodeling or renovation projects with audio-visual scope will require the services of a third party Commissioning Agent.

1. Commissioning Agent must have a Certified Quality Technician (CQT) certification through AQAV in good standing.

2. Design reviewer must have a CTS-D as well as a Certified Quality Designer (CQD) certification through AQAV in good standing.
3. Five (5) years commissioning experience on audio-visual industry.
4. Documented and verified commissioning experience with like projects and technologies as the University project being contracted.

Quality Assurance Deliverables
The AV system commissioning process, or “Quality Control,” is started during the Needs Assessment phase by the University’s Technical Representative (CITES-CCME) with the technical needs write-up. This will be the beginning of the Owner’s Project Requirements (OPR).

1. **Basis of Design [BOD]:** (the work document): The process of continually refining the AV requirements will be the work of the Architect and AV Consultant with the development of their BOD document for the physical space(s) and AV system(s). The BOD shall give the reasoning, assumptions, and formulas used to determine layouts, equipment chosen, and the expected levels/results in an objective manner throughout the AV system ending with the end-user’s experience—in other words, the combination of technology and environment for total human experience.

The very first program statement from the design team will include an AV System Performance Specification information sheet for each space and/or type of space in the project. Please see Exhibit 27 40 00-1 AV System Performance Criteria located at http://www.fs.illinois.edu/resources/facilities-standards/exhibits.

2. **Design Phases and Contract Documents:** The BOD shall be updated and submitted for review and approval by the University’s Technical Representative (Technology Services-CCME) with each of the design phases’ deliverables.

The bid document will show the final product of all work in narrative and
drawings in a clear, concise, and measureable manner. Tests and testing procedures shall be a part of these bid documents. Any bid addendums issued that may cause an elimination, addition, or modification to the individual test items required and/or testing procedures must also be included. Please refer to section 4, Testing and Testing Procedures.

3. **After Awarding:** Once the AV portion of the bid is awarded, engineering work of the AV Integrator will be requested. This work will show the reasoning, assumptions, and calculations used for the Integrator’s full project submittal, bill of materials, and installation plan. Any project-change orders or approved substitutions, modifications, or installation variances issued that may cause a modification to the tests required and/or testing procedures must also be included. Please refer to section 4, Testing and Testing Procedures.

4. **Testing and Testing Procedures:** All information from OPR through construction, and up to Final System Checkout, will be tracked and used where applicable by the Consultant to develop a final set of current and relative tests and testing procedures that will be carried out by the AV Integrator at the proper times. Any changes to these tests and testing procedures will be developed in a cooperative manner with input from the AV Integrator and will be updated to reflect system changes or changes with the project as a whole. These tests and testing procedures will be submitted to the University’s Technical Representative (Technology Services-CCME) for final approval before any testing. All testing and testing procedures will follow the Association for Quality in Audio Visual Systems (AQAV) procedures. See AQAV.org for additional information.

5. **Milestones:** The main AV milestones for verification will start with conceptualization / schematic design, depending on the first AE deliverable, and will end with completion of warranty. The documents being used for quality assurance, along with when and what for are:

**Minimum Designer Verification and Deliverables.**
- Exhibit 00 01 00-1, AE Minimum List of Deliverables (for Fee Negotiations); will be a reference throughout contract for timing of general AV and other deliverables.
- Exhibit 27 40 00-1 Performance Specifications; will be used to give parameters to which the AV system will be designed for and for system commissioning.
- Exhibit 27 40 00-2 AV basis of Design; will be used to show AV design reasoning, assumptions, and formulas. Continually updated throughout design phases and throughout construction.
- Exhibit 27 40 00-3 AV Systems Design Review; will be used to review system design submittals.
- Exhibit 27 40 00-4 submittal Drawing Checklist, AV Systems and Equipment; will be used to verify the designer’s drawing package is ready for bid, concise, accurate, and easily understandable.

**Compliance and References**

**Industry standards, guidelines, and best practices (InfoComm):**
1. ANSI/ INFOCOMM 3M-2011 Projected Image System Contrast Ratio

**Quality Management is guided by The Association for Quality in Audio Visual Technology (AQAV, and that association’s standard)**
1. AV 9000:2017 Quality Management System (or latest revision)
Conduit, pathway, and dedicated equipment room considerations shall follow:

1. ANSI/TIA-569B Commercial Building Standard for Telecommunications Pathways and Spaces

Acoustical guidelines for classrooms, consult:

1. ANSI/ASA S12.60; Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools

Intelligibility of sound systems and public address systems:

1. NFPA 72; National Fire Alarm and Signaling Code

Further Reference

1. Davis and Davis, 1987 “Sound System Engineering”
3. 2010 Standards for Accessible Design, Americans with Disabilities Act

Design Considerations

This is a partial listing of design considerations. No one document is going to cover all details for all projects. This section is meant to give general AV design considerations relating to the building mechanical design, sightline considerations, and infrastructure guidelines.

For further considerations relating to AV please consult with the University’s Technical Representative (Technology Services-CCME).

Line of Sight: The coordination of the room layout (e.g. the three-dimensional location of seating relative to blackboards, projection screens, equipment cabinets, etc.) and the installation of audio-visual equipment to ensure optimal lines of sight for all occupants, and the optimal projection lines and field of view for the AV equipment is of special importance in the design of classrooms and lecture halls.

Coordination of Ceiling Height / Interstitial Areas: The bottom of the image will be placed so all audience members can see the complete image. Therefore, the height of the finished ceiling will have to account for this requirement to allow for the actual extended screen (or image height).

This is typically the biggest building design challenge with implementing AV and requires special attention at the beginning of the design when the building’s floor heights are being determined, and must take into account:

1. Seating capacity requirements that will determine the size and layout of the space;
2. Screen size and placement necessary to properly cover the intended area and display the intended content;
3. Above ceiling area required for mechanical equipment.

Allow for conduit / cable tray, media support accommodations (projector lifts, speaker housing, etc.), and other specialty equipment in the area above the finished ceiling and below the deck of the floor above.

All AV support/mounting accommodations will be attached directly to the building’s structure and not shared with any other support structure for other building systems. AV mounting accommodations must be vibration free.

Projection Screen(s):

Screen Size: When displaying images, there is a direct relationship to the room seating. When calculating the image height to be displayed, measure the distance to the farthest seat from the screen. For detail type of viewing (most common use) divide the distance by six (6). This will give you the minimum image height required. The width of the image should accommodate a 16:10 aspect ratio for computer resolutions.

Screen Type: The material for the screens will have a matte white finish. Choosing between a manual pull-down screen and an electrically operated screen will be determined by the physical layout of the room and the project budget. All screens ten (10) feet or wider will be electrically operated.

Placement of the First Row: The first row of seats will not have a vertical viewing angle greater than 30° (thirty degrees).

Intelligibility: All sound systems and public address systems must be intelligible. This intelligibility requirement has a direct relationship to room acoustics, required volume, and minimal system distortion.
The NFPA 72; National Fire Alarm and Signaling Code, is referenced for the speech intelligibility requirements and testing procedures that it contains for designing sound systems and public address systems that may be part of a campus emergency alert system (for immediate or future use).

**Acoustics / Sound Transmission:** Internal acoustics are more critical in the design of rooms with AV than in most other types of spaces. These rooms will also be designed and constructed so as to minimize sound transmission into and out of the spaces. Avoid locating rooms with AV close to exterior and interior noise sources such as service entrances, equipment rooms, restrooms, or high traffic areas. Take appropriate measures to minimize unwanted noise in rooms with AV for instruction.

ANSI standard; *Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools* (ANSI/ASA S12.60) will be used as a baseline for classrooms and ancillary learning spaces that do not exceed 20,000ft³.

For specialty rooms such as rooms using video and audio conferencing technology and/or recording, the noise control requirements are even more stringent.

Acoustical design goals need to be established early on by the architect so all structural and mechanical designs can conform to these criterion. Further, these designated design goals are a baseline for the AV design (amplifiers and loudspeakers). Designs and/or construction that fail to develop a reasonable acoustical environment will prevent the successful implementation of AV into the space.

**HVAC:** The portion of the HVAC system that is designed for an AV enhanced room will be designed and constructed with special consideration given to noise control.

Each large venue projection booth and AV equipment room will have a dedicated HVAC system tailored to the specific needs of the area being served and will create positive pressure to keep dust at a minimum. To create positive pressure and for occupancy requirements, a minimum amount of outside air shall be supplied from a central AHU. The dedicated system will control the temperature and humidity of the space.

All AV rooms that are heavily equipped and generate more heat than can be reasonably vented year round will allow for maintaining proper temperature and humidity with the implementation of specific control strategies. These rooms must be evaluated and if there is a continuous process load due to AV and/or other equipment they must have a dedicated cooling system. These rooms may also need a minimum amount of outside air due to occupancy schedule of equipment operators. The dedicated systems will be subject to the University's requirement to utilize Campus Central Chilled Water unless it is not available or can be proven not to be economical/practical, in which case a variance request must be submitted.

**Electrical:** In a room with AV enhancements, the various equipment locations will have their power supplied from the same phase and power panel wherever possible. In rooms that are heavily equipped with AV, dedicated audiovisual power panels must be considered. In either venue, the circuits (or power panel) will be dedicated to the AV needs and isolated from other electrical needs of the room.

**Conduit Pathway:** Follow ANSI/TIA-569B Commercial Building Standard for Telecommunications Pathways and Spaces for determining conduit capacity, conduit routing, and pull-box positioning and layout. The conduit pathways will utilize sweep bends and pull-boxes; no hard 90-degree bends will be used. All pull-boxes will be easily accessed and promote ease of use.

**Lighting:** Electrical lighting in AV enhanced rooms is not only planned using the University of Illinois at Urbana-Champaign Facilities Standards, but there are special lighting/darkening requirements for note taking and media projection. Determination of lighting controls is part of the architectural planning process, and must account for AV usage and requirements.

In rooms with AV projection, pendant lighting fixtures will be designed to allow the AV projected image light to be properly displayed.
onto the screen. The lighting fixtures must not block the projection path, or direct/reflect too much light on the screen surface.

**AV Cores:** The University of Illinois Technology Services has basic reference designs (Cores) to be used when designing classroom AV systems. The information on the Cores can be found at [http://go.illinois.edu/AVCores](http://go.illinois.edu/AVCores)

**AV Hardware List**

1. Equipment racks will be Middle Atlantic or Lowell brands unless an alternate is approved by University’s Technical Representative (Technology Services-CCME). Equipment racks will be designed to allow for future upgrades or additions to the system. No more than 75% of the rack space will be filled.
   a. Work surface height adjustability (floor to top of work surface)
      i. 42”H (fully-raised)
      ii. 34”H (fully-lowered)
   b. Total lower internal area (nominal) 19.74”W x 21.44”D x 21.74”H
   c. Keyboard tray
      i. 20”W x 11.63”D x 1”H - 2.38”
      ii. Pulls out 7.94”
      iii. Can be flipped and used as a drawer
   d. 3” Twin Wheel casters
   e. Work surface is constructed from 1” thick NAUF (No Added Urea Formaldehyde) composite board with .030” high-pressure laminate on one face, and a balancing phenolic backer on the opposing face
   f. Metal components consist of 16-gauge steel
   g. Work surface edges are covered with 3mm vinyl
   h. All metal components are finished with a scratch-resistant powder coat epoxy

2. Lecterns (small) will be Spectrum Industries brand or fabricated by the University of Illinois’ Mill Shop. Lift mechanism must be electric.
   a. Work surface height adjustability (floor to top of work surface)
      i. 42”H (fully-raised)
      ii. 34”H (fully-lowered)
   b. Total lower internal area (nominal) 19.74”W x 21.44”D x 21.74”H
   c. Keyboard tray
      i. 20”W x 11.63”D x 1”H - 2.38”
      ii. Pulls out 7.94”
      iii. Can be flipped and used as a drawer
   d. 3” Twin Wheel casters
   e. Work surface is constructed from 1” thick NAUF (No Added Urea Formaldehyde) composite board with .030” high-pressure laminate on one face, and a balancing phenolic backer on the opposing face
   f. Metal components consist of 16-gauge steel
   g. Work surface edges are covered with 3mm vinyl
   h. All metal components are finished with a scratch-resistant powder coat epoxy

3. Lecterns (Large) will be Spectrum Industries brand or fabricated by University of Illinois’ Mill Shop.
   a. Lectern is 62”W x 30”D x 32.5”-40”H
   b. Equipment Rack is 14RU in front, 10RU in back
   c. SCS Indoor Advantage Certified
   d. Meets or exceeds applicable ANSI-BIFMA test standards
   e. Warranted to be free of all defects in materials and workmanship for 10 years
   f. Designed and assembled in Chippewa Falls, WI USA

4. All display devices must be laser with a minimum native resolution of 1920x1200 and an aspect ratio of 16:10. The exception is for ultra-short throw projection, which may have a lower resolution of 1280x800. Any display slaved to an ultra-short throw must be of the same aspect ratio. Display devices must be capable of accepting digital inputs such as DVI-D, Display Port or HDMI. Approved manufacturers are NEC and Epson unless an alternate is approved by University’s Technical Representative (Technology Services-CCME).

5. University of Illinois, Technology Services-CCME control equipment is exclusively AMX brand for touch panel applications and Extron brand for small room push button control systems unless otherwise specified. The control system must be compatible with the campus Universal Systems Manager (USM) monitoring system. If a system requires a control product that cannot be supplied by AMX or Extron any variation will not be accepted without written permission from the University’s Technical Representative (Technology Services-CCME). In such cases, the relevant data sheet must be supplied to the University’s Technical Representative (Technology Services-CCME) before the design is approved and installation arranged.
6. AV Switchers, Distribution Amplifier’s (DA), Extenders, and scalers must be Extron or AMX brand for typical spaces. The switcher must be capable of the following minimums:
   a. HDCP compliance with full key management on all inputs and outputs.
   b. EDID management
   c. Scaling/frame rate conversion
   d. HDMI Audio embedding and de-embedding
   e. 1920x1200@60Hz
   f. Color space management

7. AV over IP equipment can be used where applicable. University of Illinois, Technology Services-CCME requires AMX SVSI AV over IP devices. Any other system specified must be approved and tested by University’s Technical Representative (Technology Services-CCME) and University of Illinois’ Networking before being placed on the campus network. The following products have been tested and verified for use by University’s Technical Representative (Technology Services-CCME):
   a. AMX SVSI 2000 series low latency.
   b. AMX SVSI 2000 series 4k.

8. A Radio Frequency (RF) Assistive Listening System must be used in any space with an amplified audio system. Listen Technologies is preferred. The supply and installation of any hearing augmentation system into a teaching space is to comply strictly with the following:
   a. ADA Standards for Accessible Design
   b. RF receivers with a minimum of 95% coverage
   c. 1 RF receiver for every 25 persons up to 500 persons

9. Audio Digital Signal Processors (DSP) must be BSS or Extron brand unless an alternate is approved by University’s Technical Representative (Technology Services-CCME).

10. Audio amplifiers must be Crown or Extron brand unless an alternate is approved by University’s Technical Representative (Technology Services-CCME).

11. Speakers and line arrays must be JBL Pro, Rhenkus Heinz, or Extron brand unless an alternate is approved by University’s Technical Representative (Technology Services-CCME).

12. Flat panel monitors must be NEC unless an alternate is approved by University’s Technical Representative (Technology Services-CCME).

13. Mounting for projectors and monitors must be Chief brand unless an alternate is approved by University’s Technical Representative (Technology Services-CCME).

14. Microphones
   a. Lapel and Hand Held must be Shure QLXD
   b. Gooseneck must be Shure brand
   c. Wireless Conferencing must be Shure or Revolabs brand
   d. Ceiling Microphones must be Shure or Beyerdynamic brand

15. Document cameras must be Elmo brand unless an alternate is approved by University’s Technical Representative (Technology Services-CCME).

16. Lecture capture must be Extron or Echo brand. Actual equipment must be verified by University’s Technical Representative (Technology Services-CCME) and, if applicable, the department involved with the project.

17. Lecture capture cameras must be network device as well as having a HDMI or HD-SDI output. Axis model V5915.

18. Wireless video devices must be Mersive Solstice with an extra 3-year warranty. Setting up of these units will be coordinated with CCME to make sure network settings are correct.

19. Ceiling boxes must be FSR brand 1x2 or 2x2 ceiling boxes.
   a. CB-12
   b. CB-22
20. Equipment boxes located behind flat panel displays must be Chief Manufacturing brand.
21. All PC’s will be owner furnished equipment unless noted.