

AV Basis of Design

Illinois Project #:		Project Name:
Space Location:		Space Type:
Date of Creation:		Space Usage:
Latest Revision:		Other Notes:

General Information

Room Types	Presentation Room
Room Numbers	1
System Type	AV Presentation
Room Size	25'D x 22'W
Ceiling Height	10'-8"

Architectural Integration Items

1. Equipment Racks	
Type	Small type
Location	Built into lectern
HVAC Load	Approx. 1,500 BTU each
2. Video Projectors	
Quantity	One per room
Location	Off-center of room to match side screen location.
Mounting	Ceiling mounted
Size (Clear Dimensions)	12" H x 12" W x 18" D Weight – 30 Lbs. (Approx.)
AC	1 – Outlet
HVAC Load	Approx. 2,000 BTU each
3. Screens	
Quantity	One per room
Type	Pull-down w/ heavy-duty hardware
Sizes (Image Dimensions)	50"H x 80"W 16:10 Aspect Ratio
Location	Front Wall of Room Off center to stage right side
Mounting	Ceiling flush mounted
AC	None

EXHIBIT 27 40 00-02 BASIS OF DESIGN REPORT

Provided by	General Contractor
4. Lecterns/Mill Work	
Type	Custom made lectern Provided by owner's Mill Shop
Specific Features	<ul style="list-style-type: none"> ◆ Room for small equipment rack ◆ Removable front access panel for rear access to rack. ◆ Hinged lockable front door ◆ Room for control/connector panel on top surface
Wiring	Umbilical to wall plates with cover
5. Computers	
Provided by	Provided by user as needed
Type	Laptop
Jack/Interface Location	Wall plate on top of lectern
6. Program Speakers	
Quantity	2
Location	Front wall of room, left & right of screen
Mounting	Wall surface mounted
Mounting Height	7' 0" A.F.F.
Size	9" H x 8" W x 6" D (Approx.)
7. Control Plates	
Control Plate w/ Buttons	Wall plate with surface box on top of lectern
8. AV Connector Plates	
Location	Wall plate with surface box on top of lectern
Type	Pre-manufactured wall plate
AC	AC outlet part of wall plate
Net	Net outlet part of wall plate
9. Wall Plates	
Location	Front of room, to side of lectern
AC Plate	Adjacent to AV wall plate
Net Plate	Adjacent to AV wall plate
10. Room Lighting	
Type	Wall switches
Switch Location	At doorways and front of room
Fixtures	Two tube linier fluorescent
Circuiting	Zone 1 – Fluorescent – 1 st tube Zone 2 – Fluorescent – 2 nd tube Zone 3 – Fluorescent row near screen
Provided by	Provided by E.C.

EXHIBIT 27 40 00-02 BASIS OF DESIGN REPORT

11. Security	
Locks	Locks are provided in the front and back of the lectern and the wall plate cover.
Wall Plate Cover	A custom built millwork box covers the wall plates as a shroud. Provided by owner's Mill Shop
Harness	A physical aircraft cable harness connects the lectern to the wall plates and runs within the cable umbilical.
Electronic Security	The owner provides an electronic security system

Sample Only

System Description

A. A/V System:

1. Room is equipped with A/V presentation system. The AV system is a small system and characteristic of the type of system that is used in a small classroom or conference room.
2. A lectern is located in the front of room. The lectern is provided by the University's Mill Shop and is not provided by the AV contractor. The lectern houses small equipment rack which encloses most of the electronic equipment. The electronics tie into the room via a umbilical cable to wall plates.
3. Video images project on pull-down front projection screen, located on the front wall of the room. The screen is mounted to the side of the front wall to allow for additional room for presenter. Video projector is mounted to the ceiling in front of each screen.
4. The A/V presentation system provides audio and video playback of program material. Sources include a rack mounted Blu-ray/DVD/CD player, an HDMI connector, VGA input connectors, RCA input connectors. Portable, user furnished, laptop computers or other AV devices may be plugged into the connectors that are mounted to a wall plate on the top of the lecterns.
5. Program audio sources (computers and Blu-ray, etc.) are reproduced through a program audio system. The speaker system consists of front left and right speakers. The speakers are wall-mounted with wall mount brackets. The amplifiers are rack mounted in the lecterns.
6. The systems include push button control panels. The control panels are mounted to surface mounted boxes on the top of the lecterns. There is a network feed from each of the control panels. Control system programming is provided by the university's AV department (U of I Technology Services CCME) and not the AV contractor.
7. An elaborate security system is Owner provided. The security system is provided by the university's AV department (U of I Technology Services CCME) after the completion of the AV contractor's work on the project. The AV contractor will provide one serial wire from the rack to the video projector and one ¼" aircraft cable, within the cable umbilical from the rack to the wall plates. Physical aircraft cable harnesses connect the lecterns to the wall plates and run within the cable umbilical. Custom built millwork boxes cover the wall plates as shrouds. The box covers are provided by university's Mill Shop.

Sample Only, the designer will need to provide calculations based on the system being designed.

Design Calculations

Display Height

S_H is the required minimum screen height.

$$S_H = D / S_L$$

Where:

D = Distance to the farthest viewer of the screen

S_L = Level of screen detail (4 = Inspection, 6 = Detail & 8 = General Viewing)

$$D = 25' (300")$$

$$S_L = 6$$

For the above project variables, the S_H is 50"

Screen Resolution

Because of the proliferation of WXGA computer display resolutions, a **Screen Resolution of 1280 x 800 (WXGA)** is required.

Screen Size

Screen Size is the width and calculated height of the screen for the desired aspect ratio.

Aspect Ratio = 16:10 (For computer data display resolution)

For the above aspect ratio, the *Screen Size* is 50"H x 80"W

Screen Area

A is the total surface area of the screen.

$$A = H \times W$$

Where:

H = Screen Height

W = Screen Width

$$H = 50''$$

$$W = 80''$$

For the above project variables, the **A is 4000 Sq. In. (27.8 Sq. Ft.)**

Image Luminance

Lumens is the required projector lumen output.

$$\text{Lumens} = ((L \times 15) \times A) / .75$$

Where:

L = Ambient light level at screen location

15 = Desired contrast ratio (For "Basic Decision Making" category for ANSI/InfoComm Projected Image System Contrast Ratio Standard)

A = Screen Area (in Square Feet)

.75 = Performance derating value (25%)

Note: Assumes a 1.0 screen gain

$$L = 8 \text{ Foot Candles (Estimated)}$$

$$A = 27.8 \text{ Sq. Ft.}$$

For the above project variables, the **Lumen requirement is 4,448.**

Computer Video Signal Bandwidth**Highest Frequency (HF)**

$$HF = ((H_{pix} * V_{pix} * f_v) / 2) * 3$$

Where:

H_{pix} = Total number of horizontal pixels

V_{pix} = Total number of vertical pixels

f_v = Refresh rate

$$H_{pix} = 1920$$

$$V_{pix} = 1200$$

$$f_v = 60$$

For the above variables, the Computer video signal bandwidth (**HF**) is **207.36 MHz**

Computer Video System Bandwidth

Signal Frequency (SF)

$$SF = HF * 2 \text{ (Minimum)}$$

$$SF = HF * 3 \text{ (Maximum)}$$

Where:

HF = Highest frequency

$$HF = 207.36 \text{ MHz}$$

For the above variables, the minimum signal frequency (**SF_{MIN}**) IS **414.72 MHz**

For the above variables, the maximum signal frequency (**SF_{MAX}**) IS **622.08 MHz**

Speaker Coverage Calculation

$$D = 2 * (H - h) * \tan (C / 2)$$

D = Diameter of the loudspeaker's coverage circle at ear height
 H = Overall ceiling height
 h = Height of the listener's ears
 C = The loudspeaker off-axis coverage angle of the polar pattern

SPL Required

SPL is the required sound pressure level.

$$SPL = BGN + 20 + HR$$

Where:

BGN = Background noise level (dBA)

HR = Desired headroom (dB)

BGN = 45 (Estimated)

HR = 10 dB

For the above project variables, the required **SPL is 75 dBA.**

Electrical Power Required (EPR)

EPR is the electrical power required at the amplifier output.

$$EPR = 10^{\frac{SPL + H - L_S + 20 \log(D_2/D_r)}{10}}$$

Where:

SPL = Desired Sound Pressure Level

H = Headroom

L_S = Loudspeaker Sensitivity (1Watt at 1 Meter)

SPL = 80 dB SPL

H = 10

L_S = 89dB 1W/1M

$$D_2 = 4.4'$$

$$C = 110^\circ$$

For the above variables, the **EPR is 2.27 Watts.**

Loudspeaker Impedance

Loudspeaker Impedance (Z_t) is the total impedance of all the loudspeakers in a circuit.

$$Z_t = Z/N$$

Where:

Z = the measured impedance of a sample speaker

N = Number of speakers in the circuit

$$Z = 753 \text{ ohms}$$

$$N = 2$$

Amplifier Wattage (per Channel)

Amplifier Wattage (W_t)

$$W_t = W*N*1.5$$

Where:

W = Wattage tap used at the individual speaker.

N = Total number of loudspeakers

1.5 = Upsizes the power amplifier by 50%

$$W = 7.5 \text{ watts}$$

$$N = 2$$

For the above variables, the amplifier with a minimum **22.5 watts should be used.**

For systems where ceiling microphones and user microphones are used a separate PAG/NAG will need to be calculated for both systems.

Potential Acoustic Gain (PAG)

$$PAG = 20\log[(D_0 * D_1)/(D_2 * D_S)]$$

Where:

D_0 = Distance from source to listener

D_1 = Distance from loudspeaker to mic

D_2 = Distance from loudspeaker to listener

D_S = Distance from Source to microphone

D_0 = 20' approximately

D_1 = 4.4'

D_2 = 4.4'

D_S = 1.5'

|For the above variables, PAG is 22.5dB

Needed Acoustic Gain (NAG)

$$NAG = 20\log(D_0/EAD)$$

Where:

D_0 = Distance from source to listener

Equivalent acoustic distance (EAD) = 6

D_0 = 20' approximately

EAD = 6

|For the above variables, NAG is 14dB

Final Potential Acoustic Gain (PAG_F)

$$PAG_F = PAG - 10\log(NOM) - FSM$$

Where:

D_0 = Distance from source to listener

Equivalent acoustic distance (EAD) = 6

$D_0 = 20'$ approximately

EAD = 6

For the above variables, $PAG_F = 16.5\text{dB}$

Sample Only

Budget

	Sub-System Description	Budget Each	System Count	Budget Extended
	AV System	\$ 0	0	\$ 0
	Lectern	\$ 0	0	\$ 0
	Custom Millwork Provided by U of I Mill Shop			
	Wall Box Cover	\$ 0	0	\$ 0
	Custom Millwork Shroud Provided by U of I Mill Shop			
	Screens	\$ 0	0	\$ 0
	Pull Down Type Part of G.C.'s scope			
	Total			\$ 0
	The following items are not included in the AV system budget:			
	Computers			
	Conduit & AC power system			
	Architectural integration by G.C.			
	A/V Design Services			
	Lighting Fixtures & Dimmers			
	TV (Cable) Distribution System			
	U of I TECHNOLOGY SERVICES CCME Programming, Commissioning and Support			
	Lecterns			
	Wall Box Cover			
	Screens			
	This budget represents a budget estimate only. It does not constitute an offer to sell such products and services or a guarantee that the specified materials of labor can be purchased for the estimated prices.			

Form is based on original form courtesy of Lipp A/V Design Inc.