Consultants in Acoustics, AV & Technology

Vermont State Capitol AV Systems Renovation

CONCEPTUAL ASSESSMENT AND NARRATIVE

5777 Central Ave., Suite 225
Boulder, CO 80301
303.865.5500 main
303.865.5504 fax
www.thisisk2.com

EXECUTIVE SUMMARY

Funding was appropriated in FY 2019 to the Sergeant at Arms to contract with a third party to conduct an assessment of the sound system in the State House and 1 Baldwin Street pursuant to 2 V.S.A.§ 62(a)(8). This document constitutes that assessment, and presents a summary of findings and recommendations for renovations of the Audio/Visual (AV) systems at the Vermont State Capitol.

The design concepts and recommendations described in this document are based on a needs analysis performed by K2 during a site visit completed on September 27, 2018, and the conversations held at that time with stakeholders for the State. It is intended that this report be used for review of the conceptual design and cost estimates, and to guide the future development of detailed AV designs and the subsequent installation of the AV systems.

Background

Most of the audio and video systems currently in place at the Vermont State Capitol have reached the end of their expected lifespan or will be at that point soon. Many have been modified and upgraded over the years with incremental changes that provided the functionality needed by the State at the time of the upgrade. This has resulted in many systems that are not cohesive and are difficult to troubleshoot. There is serious concern about the health of critical systems including microphones and sound reinforcement systems at both Chambers. Because of their age and custom nature, it is difficult or impossible to find replacement parts for many of the existing systems. While the systems have performed very well over the years and provided the State with very important functionality, there is concern that many of the spaces are one failure away from being unusable.

Given the age and technology currently in use, this report assumes that all existing components and systems will be replaced as part of a renovation. We do not recommend reuse of any AV equipment.

Objective

The primary objective of this project is to modernize the AV systems at the Vermont State Capitol to provide new technology that supports the needs of the State and its Legislature, and allows those present at legislative and related events to clearly and effortlessly hear one another, and see all presentation materials. Each space is to be provided with systems that match its functional requirements while conserving the historic nature and aesthetics of the facility. Any recommendations made shall minimize the impact on architecture and the requirements for construction, and shall also minimize any negative visual impact.

The following spaces are included in the scope of the AV renovation:

- House Chambers
- Senate Chambers

- Cedar Creek Room
- Cafeteria
- Ethan Allen Room
- Legislative Committee Rooms
- Multipurpose Room 10
- Multipurpose Room 11
- Bell System/Emergency Public Address System
- Legislative Session Loudspeaker Distribution
- Recording, Archival, and Streaming Services System

Requirements

Per the *Vermont General Assembly Request For Proposal For Audio System Analysis/Design*, "The General Assembly requires a fully integrated, comprehensive, modernized, scalable system that incorporates all the functions of the Existing System plus new features that may be appropriate for the governmental and nongovernmental uses of the buildings."

New system requirements include the following items:

- Shall be ADA compliant
- Be secure against tampering and exploitation
- Have tiered access to system controls and functions from remote locations
- Include capabilities for predefined functions and settings
- Have zoned override capabilities for emergency communications

K2 has taken all of these factors into consideration when generating this report, and the systems that are outlined below incorporate these requirements into the proposed new systems.

Design Considerations and General Notes

When reviewing this report, the following items should be taken into consideration:

1. The *Proposed New System* section for each room assumes that network ports are available or will be installed to support the new AV system.

2. Prior to the installation of new AV equipment for a room, a Radio-Frequency (RF) scan should be performed to ensure there are no competing interference signals for rooms specified to

use RF devices to include hearing assist equipment, wireless microphones, and/or wireless video components.

3. The AV Equipment procured in the upgrade of each room should be compatible so that a building-wide networked AV solution is 100% compatible. For example, the Audio DSP processors should all be in the same product family from the same manufacturer for each room that requires such a device. In addition, careful consideration should be taken to ensure that different equipment from different manufacturers are able to properly communicate with one another over the network.

4. With a supporting network configuration, the mobile video carts that are defined for some of the rooms could be deployed in any location throughout the building. This would allow video to be streamed from any room that has a video encoder to a mobile video cart that has the video decoder and display. This would be beneficial for corroborating AV situations that require flexibility in configurations.

5. As rooms are upgraded from the existing analog-based systems to digital-based systems, digital-to-analog converters and/or analog-to-digital converters would be required to help bridge the old and new systems together. Adhering to a logical, phased implementation for integrating new AV systems with the existing AV systems would help minimize the need for these “bridge” components.

HOUSE CHAMBERS

The audio and video systems for the House Chambers shall be designed to complement the architectural design of the space, while satisfying the functional requirements of the State of Vermont House of Representatives' legislative functions.

Current System Overview

Video Presentation

Currently, there are two manual video projection screens that are raised (from floor-level) in front of the windows behind the rostrum. Portable projectors are brought into the room when required to display on these screens. The video system is limited to analog video technology using 4:3 aspect ratio (standard definition). The location of the screens and limitations on light control at the Chambers make it difficult to project images with high contrast and quality.

One of Two Existing Projection Screen Locations (Looking Down)

One of Two Existing Projection Screen Locations (Looking Up)

Audio System

The current audio system includes handheld microphones on retractors located at each desk. Each microphone is shared between two Members. Several of the existing microphones have been damaged and are no longer functional. There are wireless microphones that are used on occasion as well.

For sound reinforcement in the room, four loudspeakers are hidden in decorative radiator panels located at four interior corners of the center section of the room, and cross-fire towards the outside wall. This arrangement creates highly uncontrolled sound that energizes the space unnecessarily and makes audio feedback (the loud ringing sound heard when sound loops between an audio input and an audio output) difficult to control.

There are a number of press feeds located in the balcony. The type of output jacks beneath the seats in the balcony include XLR (line-level) and banana plugs (loudspeaker-level). One corner of the balcony has a large white box that presumably contains an output distribution amplifier to feed these jacks.

Control System

Interfacing with the House Chambers AV equipment is a manual process. Adjustment of microphone and loudspeaker levels is performed by manually turning rotary knobs on the front of the Shure SCM810 mixers and TOA A-912MKII mixer/amplifiers. Control of the system is only available physically at the AV equipment rack, and there is no way to remotely control system settings.

Bell System

A custom interface panel is located at the rostrum that allows the Clerk to activate the Bell System when desired. Engaging the switch will trigger a chime and light to activate in all the rooms that have the alert panel installed.

Bell System Interface at Clerk Desk

AV Equipment Rack

One large AV equipment rack houses all of the supporting audio and video electronics for the House Chambers. The components within the rack include microphone mixers, mixer/amplifiers, an assisted hearing device, and a DVD player.

The AV equipment supporting all of the House Chambers is listed in the following table.

Table 1.1 - House Chambers Existing AV Equipment

Location	Description	Manufacturer	Model Number	Quantity
House Chambers Desks	Retractable Microphone	Unknown	Unknown	75
	Table Panel w/ Mic & Hearing Assist Jacks	Custom	Custom	75
North Side of AV Rack	Microphone Mixer	Shure	SCM810	11
	Audio Monitor	Unknown	Unknown	1
	Audio Monitor	RCA	Unknown	1
	Mixer/Amplifier	TOA	A-912MK2	8
	Lockable Drawer	Middle Atlantic	DR5	1
South Side of AV Rack	Work Lamp 1RU Panel	Custom	Custom	1
	Microphone Mixer	Shure	SCM810	2
	I/O 1RU Panel	Custom	Custom	1
	DVD Player	Toshiba	SD4300	1
	Assisted Listening Equipment	Audio Technica	Unknown	1
	Mixer/Amplifier	TOA	A-912MK2	5
	Lockable Drawer	Middle Atlantic	DR5	1
Clerk Desk	Gooseneck Microphone	Audio Technica		2
	Microphone Attenuator	Audio Technica	AT8684	2
	VGA & Stereo-mini input	Custom	Custom	1
	Call Panel	Custom	Custom	1
Speaker of the House Podium	Gooseneck Microphone	Audio Technica		1
	Custom Switch Panel	Custom	Custom	1
	Wireless Microphone Receiver	Shure	PGX4	1
	Wireless Microphone Receiver	Shure	SLX4	1

Location	Description	Manufacturer	Model Number	Quantity
House Chambers Floor	Manual Projection Screen	Unknown	Unknown	2
	Loudspeakers	Unknown	Unknown	4
	Audio I/O Cable & Connector	Unknown	Unknown	1
Balcony	Ceiling Loudspeakers	Unknown	Unknown	4
	Custom Output Panels	Custom	Custom	14
	Custom Hearing Assist Panels	Custom	Custom	2

Suitability for Future Expansion

The audio components within the current system are all analog in nature, and options for expansion are limited by the architecture of the individual devices. The Shure SCM810 microphone mixers can only support a maximum of eight microphones each, and therefore a total of thirteen mixers are needed to support all of the desk microphones within the House Chambers. The mixed audio output from the SCM810 mixers feed into select TOA A-912MK2 mixer/amplifiers, which in turn will power one loudspeaker. The ability to properly mix a large number of microphones to feed into select loudspeakers is not possible in this configuration. The idea of expanding the audio system with additional analog components is not practical, and presents additional challenges from the viewpoint of the individual operating volume levels and mute features during real-time legislative sessions. In addition, there is not an elegant, or inexpensive, way to mix all of the microphones together to allow for transmitting audio to an overflow room.

Although video presentations are not part of typical legislative sessions, stakeholders stated that the option to present video material does arise from time to time. The existing location of the two projection screens in the House Chambers does not allow for suitable viewing from many of the seats in the room. Individuals located farther away from the projection screen will find it difficult to see the content being presented. In addition, there is not a practical way of transmitting video to multiple locations within the room without having to run video cables across the floor, thereby potentially creating tripping hazards. The ability to add additional displays throughout the room to support appropriate viewing for individuals located throughout the space would require video splitters, cabling, and additional flat panel displays or projectors and video projection screens. If the video being presented also contains audio, there would need to be an interface that would allow this audio to be fed to the existing system. Based on the location of the existing loudspeakers, audio intelligibility would be poor for most of the individuals in the room.

Practicality of Continued Maintenance

Considering the age of the retractable microphones at each desk, and the inability to purchase identical microphones to replace them when more fail, maintenance of the sound system in the House Chamber will increase over time. Although the Shure microphone mixers and TOA mixer/amplifiers are still being manufactured, they do not represent the ideal components to use for a modern, digital system. In addition, there is no easy way to update the existing system with additional components that would allow for a simple and intuitive control interface for the operator.

Failure Forecast

The retractable microphones at the desks will continue to degrade and fail with more passing time. During the site survey, it was discovered that at least a few of the desk microphones were either already broken or didn't work. The State House can expect to see more microphones failing within the coming years. With no off-the-shelf microphones available to replace the existing microphones, the legislative members whose microphones have failed, or could fail in the near future, will have a difficult time being heard by other members. The microphones that no longer work are unable to properly capture audio from the House legislative members, and therefore cannot be recorded or be mixed into a Press feed. This issue will continue to grow as more microphones fail.

Upgrading the House Chambers audio system should be given top priority.

Proposed New System Overview

Over the past several years, the State House has been in the process of installing a robust wired network system throughout the building. Therefore, a network-based audio, video and control system would be the most ideal system to replace the existing analog system. The number of advantages that a network-based AV solution can provide far outweigh trying to add new analog components to the existing system. Benefits of a network-based AV solution include the following:

- Minimize impact on altering the historic structure of the building due to conveyance paths already in place
- Minimize infrastructure requirements for distributing new cabling
- Vastly increased bandwidth for video, audio and control
- Ability to add video, audio, and/or control at any location where there is a network drop
- Control functions (volume, mute, recording, routing, etc.) from any location
- Reduce the amount of hardware/equipment to support AV functionality (i.e. fewer components that have far greater processing capabilities than the existing counterparts)

- Overflow options to any space throughout the building that has a network drop
- Option to install via a modular implementation for phased deployment
- Easily expanded over time

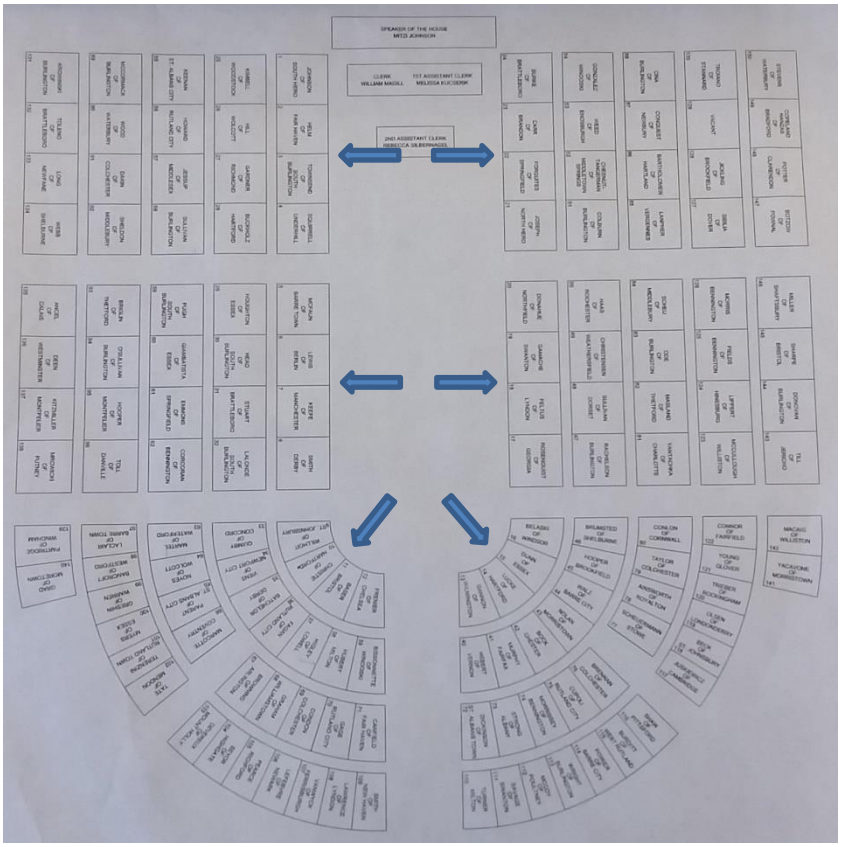
Each aspect of the House Chambers proposed AV system solution is listed in more detail in the following paragraphs.

Video Presentation

The architecture of the House Chambers greatly limits the ability to install permanent display solutions for video presentation. In addition, lighting control is not desired as it is expected that the Chambers will operate with windows open and overhead lights fully illuminated which results in high ambient light levels throughout the Chambers. While this is ideal for the function of the space, it is challenging for video projection.

Therefore, the recommended video presentation solution should be based on large format portable video displays that can be connected at multiple locations throughout the room providing adequate views from all seating locations. A networked video system based on IP video distribution technology is recommended, as it would allow flexibility in relocating displays to any location that can be provided with a network drop. Each portable display location should include a large format display supporting at least full High Definition (1920x1080) resolution, and preferably 4K resolution. Inputs to the system should include permanent wired video inputs at the AV rack, a portable video source interface to be used at network locations in the room, and a wireless video gateway allowing computer video to be sent to the displays using a USB dongle Connected to a laptop or similar device. The system should be fully matrixed to allow the source video to be sent to any and/or all displays simultaneously.

Video cameras could be used on the House Chambers floor in the same manner as other video sources in regard to transporting a video signal to the network. The video cameras should support a variety of interfaces, such as HDMI, HD-SDI, 3G-SDI, and IP. Cameras that support an IP output could connect directly to a network port, whereas cameras that support HDMI or 3G-SDI would first need to connect to a video network encoder. The encoder would convert the video signal to one supported for transmitting over the network, such as H.264 or JPEG 2000.



Recommended Portable Display Locations

Audio System

The new audio system should provide the ability for Members to speak from their desks and be heard throughout the space with high intelligibility and quality. The audio system should include audio recording and archival capabilities, as well as provide accommodations for assistive listening to be provided to the hearing impaired.

In order to minimize wiring, improve system diagnostics, and to maximize future flexibility of the system, we recommend that the audio system be based on a modern, configurable, audio Digital Signal Processor (DSP) with advanced audio networking capabilities. The audio processor should be installed at the rack and provide all processing and distribution capabilities for the system. Ideally, the DSP should be capable of operating in a redundant configuration to ensure that the audio system is fully operational even if one of the processors encounters a fault, resulting in a seamless transition to the backup processor.

It is our understanding that Members of the State of Vermont House will typically address the Chamber while standing at their desks. We recommend replacing the existing microphones with a similar configuration. Small capsule handheld condenser microphones would have the cables attached to a reeler mechanism that retracts back into the cavity when it is not in use. The solution should be

modeled after similar installations that utilize this same feature, such as the existing system employed in the House Chambers at Vermont, and systems installed in Louisiana, Georgia, and South Carolina State Houses.

The existing microphone cutout and plate would likely need to be slightly modified to accommodate the new reeler mechanisms.

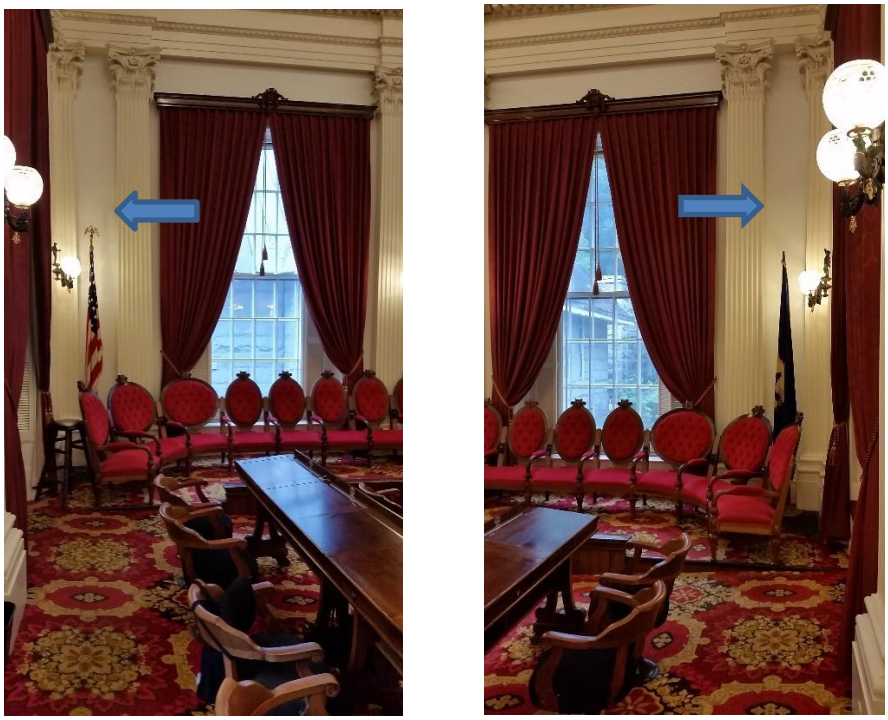
Updated Reeler Mechanisms Would Replace Existing Retractors

A single Power-over-Ethernet (PoE) audio interface would be located at every other position, and be used to provide connectivity for the microphone. The interface should use AES67, QLAN and/or Dante audio networking technology, and be compatible with the audio DSP. A single CAT6 cable would then provide the connectivity required for each audio interface back to a network switch at the AV rack.

Gooseneck microphones at the rostrum should include a portable desktop base, allowing the Speaker of the House and the Clerk to position the microphone for the best suitable location.

Multiple digital wireless microphone systems that include a lapel and handheld microphone would be available for House Members. The wireless microphones would have a sufficient transmitter range that covers the entire room.

New loudspeakers should be provided and installed at locations that minimize feedback and provide high intelligibility while having a minimal impact on the architecture. Vertical column loudspeakers with directional steering would provide the ability to direct sound only to areas where listeners are located, even when placed at non-traditional locations. The new system should include at least two column loudspeakers located at the front of the room to provide coverage for the Members' seating area. These loudspeakers should be mounted adjacent to the window wells on the far sides of the room on the wall behind the rostrum.



Recommended Loudspeaker Locations

While the main loudspeakers will provide coverage of the majority of the floor, a small desktop loudspeaker should be installed at the two main rostrum locations (Chief Clerk and Speaker of the House). These loudspeakers will ensure that those seated at these positions can clearly hear the proceedings. Connectivity to the loudspeakers should be provided using an audio interface similar to those suggested above for the Member desks and allow both the loudspeaker and microphone to be connected.

Example Desktop Loudspeaker

To achieve superior sound quality in the House Chamber, these same desktop loudspeakers could also be located at the Member positions, thereby eliminating the need for the column loudspeakers at the front of the Chambers. With this design, the relative levels of individual loudspeakers can be kept fairly low because of the loudspeaker's close proximity to the Members. This would avoid excitation of the room's reverberant field, and result in clearer, more intelligible speech. A loudspeaker could be located between each two Members, and be connected to the audio interface along with the microphone(s), thereby maintaining connectivity back to the rack using a single CAT6 cable per location. The size of each desktop loudspeaker would be approximately a 5" cube with a slope on the front side.

The under balcony and upper balcony areas will require additional coverage for sound reinforcement. For the lower balcony, we recommend replacing the existing ceiling loudspeakers with new drivers, and adding at least two new loudspeakers on each side of the room to provide even coverage.

Currently, there is no sound coverage provided for the upper balcony area other than wired outputs provided for press connections. We recommend the addition of small "pew" style loudspeakers along the balcony rail. To minimize the size, these loudspeakers should include drivers no more than 4" in diameter and be paint-matched to blend in with the balcony railing.

An assistive listening system should be provided. In order to avoid additional visual elements and minimize infrastructure work, we recommend the use of an RF-based system that can be installed at the small rack location at the balcony and provide coverage to the entire Chamber. A complement of head set receivers as well as neck loops (for use in conjunction with hearing aids) should be included for Members and other attendees to use. Upgrading to an RF-based assistive listening system would alleviate the need for all of the hearing assist jacks located throughout the room.

The House Chambers does not currently record any of the legislative sessions, nor is recording audio in the Chambers a requirement. However, the option to record would be available with the implementation of the network-based audio recording and streaming platform. See the *Recording, Archival, and Streaming Services System* section for additional information.

To support audio feeds for the Press in the balcony, new network-based audio components should be installed in the rack in the balcony. The output of the network-based audio components should support line-level signals, and should connect to new XLR jacks that would replace the existing jacks.

Bell System

The existing interface panel should be replaced with a networked interface panel. This panel would be programmed to perform the same functions as the existing bell system, and can be programmed for additional functions. The large touch panel (see *Control System* section below) could also be used to support interaction with the Bell System.

Control System

One large touch panel should be custom programmed with functions that allow the operator to easily control all audio and video aspects of the room. This should include, but not be limited to, microphone level control, loudspeaker volume control, presets, video source selection and routing, remote audio recording/archiving functions, and bell system interaction. Security precautions should be considered to avoid unauthorized tampering or adjustment of the system.

Infrastructure Requirements

As indicated above, the intent is to complete the AV renovation and upgrades with minimal impact to the architecture of the space, while minimizing any infrastructure or construction requirements. The following section summarizes infrastructure items that would need to be considered for the new AV system:

1 Cable Paths:

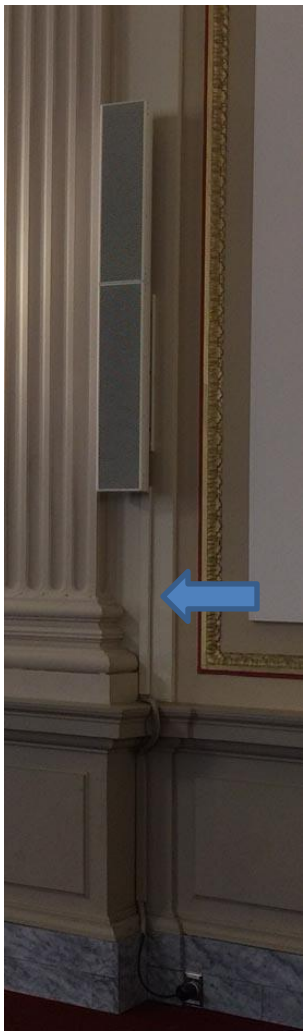
a. Desks: It is assumed that cable paths exist to all desks and would be reused. A single CAT6 cable would be required per desk which should replace the existing microphone audio and control wiring, as well as the hearing assist cables, and fit within the existing cable path.

b. Video Display Locations: Network connectivity would be required at or near the location of the portable display carts. If connectivity does not exist, a new path will need to be identified to provide it.

c. Video Display Inputs: For the wired video input locations in the Chambers, a cable path to provide a single network connection at those locations would need to be provided.

d. Balcony: A cable path exists from the main rack location to the upper balcony box. This path could be reused for line level and loudspeaker cabling to the balcony. If signal separation is not possible (i.e., if only a single conduit path is available), it is recommended that the amplifier for the balcony loudspeakers be installed at the balcony to avoid running loudspeaker and line signals side by side which would degrade signal quality. Cabling to recommended rail loudspeakers can be surface run along the railing. Power is already available at the recommended location for the AV rack at the balcony.

e. Loudspeakers: A cable path and power would be required to be provided at the new vertical column loudspeaker locations. If it is not possible or desired to cut into the wall, an alternative would be to provide power and signal connectivity at the base and run cabling for the loudspeaker discretely along the interior face of the decorative pillars on the wall.



Example of Surface-Mounted Cabling

2 Loudspeaker Mounting: In addition to the cabling mentioned above, the new vertical column loudspeakers would need to be mounted to the wall. The mount should be planned to support a device at least 80lbs in weight.

3 Equipment Racks: The existing location of the main equipment rack can be reused. This equipment rack would support housing all the proposed equipment, and adequate power is already available.

SENATE CHAMBERS

The audio and video systems for the Senate Chambers shall be designed to complement the architectural design of the space, while satisfying the functional requirements of the State of Vermont Senate legislative functions.

Current System Overview

Video Presentation

Currently, there is no video system implemented in the Senate Chambers. Based on conversations with the Secretary of the Senate, video functionality is not needed.

Press members are allowed to use portable video cameras to record sessions, both on the floor and in the balcony, but are not allowed to do any live video streaming during sessions.

Audio System

The current audio system includes miniature microphones clipped onto the back of each Member desk. Each microphone is shared between two Members.

Sound reinforcement is not desired in the room, and therefore there are no loudspeakers.

Each side of the room has one four-output line-level interface, used for Press audio feeds.

Vermont Public Radio (VPR) has access to a line output jack in the “Crow’s Nest”. Live audio streaming from this audio port is available for VPR.

Audio recording is supported by the use of a handheld audio recorder and by a PC with appropriate software located at the Secretary’s desk inside the Chamber. Audio is also fed into the PC at the Secretary’s desk from one of the Press output jacks on the east wall. The audio output jack at the Secretary’s desk is not currently functional, and therefore a cable was installed from the Press output jack in order to support the ability to record at the PC.

One audio output jack is located in the Secretary of the Senate's office. An audio cable is connected between the audio output jack and the input to the handheld audio recorder. After the recording has been completed, the recorded file is then transferred to a local computer. A backup of the audio is accomplished by using a CD-recorder in the computer.

Control System

Due to the fact that the Senate Chambers does not have any loudspeakers for voice reinforcement, there is very little interaction from personnel with the equipment in the AV rack. Interfacing with the AV equipment is accomplished by manually adjusting all of the rotary volume control knobs on the front of the Shure SCM810 mixers. Control of the system is only available physically at the AV equipment rack, with no way to remotely control volume levels in another location.

Bell System

A custom interface switch is located at the rostrum that allows the Secretary to activate the Bell System when desired. Engaging the switch will trigger a chime and light to activate in all the rooms that have the alert panel installed.

Bell System Interface at Secretary Desk

AV Equipment Rack

One small wall-mounted AV equipment rack houses all the supporting audio electronics for the Senate Chambers. The components within the rack include three microphone mixers, two mixer/amplifiers, and one assisted listening system amplifier.

The AV equipment supporting all of the Senate Chambers is listed in the following table.

Table 1.2 - Senate Chambers Existing AV Equipment

Location	Description	Manufacturer	Model Number	Quantity
Senate Chambers Desks	Clip-on microphone	Unknown	Unknown	16
Wall-Mounted AV Rack	Microphone Mixer	Shure	SCM810	3
	Mixer/Amplifier	TOA	A-912MK2	2
	FM Transmitter	Williams Sound	PersonalPA	1
	Press Panel	Custom	Custom	1
	BNC Panel	Custom	Custom	1
Secretary Desk	Gooseneck Microphone	Audio Technica		1
	Call Panel	Custom	Custom	1
	Record and Broadcast Box	Custom	Custom	1
President of the Senate Podium	Clip-on Microphone	Audio Technica		1
	Custom Switch Panel	Custom	Custom	1
Senate Chambers Floor	4-Channel Line Output Boxes	Rapco	Unknown	2

Suitability for Future Expansion

The audio components within the current system are all analog in nature, and options for expansion are limited by the hardware architecture of the individual devices. The Shure SCM810 microphone mixers can only support a maximum of eight microphones each, and therefore a total of three mixers are needed to support the desk, Rostrum and Clerk microphones within the Senate Chambers. The mixed audio output from the SCM810 mixers feed into the two TOA A-912MK2 mixer/amplifiers. The idea of expanding the audio system with additional analog components is not practical, and presents additional challenges from the viewpoint of the individual operating volume levels and mute features

during real-time legislative sessions. In addition, there is not an elegant way to mix all of the microphones together to allow for transmitting audio to an overflow room or to a network-based recording system.

Video is not currently part of the Senate Chambers AV System, nor is it desired to be added; therefore, it will not be discussed in this section.

Practicality of Continued Maintenance

The clip-on style of microphones at each desk are prone to being bumped, mishandled, or could be considered a minor distraction based on how they are attached to the desk. If a microphone is found to be non-operational, an off-the-shelf replacement could readily be found; however, the more important factor is that since the microphones are not permanently installed, they are susceptible to recurring damage due to the reasons stated above.

Even though the Shure microphone mixers and TOA mixer/amplifiers are still being manufactured, they do not represent the ideal components to use in a modern, digital system. In addition, there is no easy way to update the existing system with additional components to allow for a simple control interface for the operator.

Recordings of legislative meetings requires a multi-step process that could be simplified by implementing a digital audio solution.

Failure Forecast

The microphones and supporting audio equipment appear to be in reasonable working order. If one of the components fails or breaks, another similar off-the-shelf component can be purchased and installed with relative ease.

The audio line-output jack used for recording at the Secretary desk on the Senate floor is not functional, and the current work-around is to use one of the press line-level output jacks on the side of the room. The culprit could be a broken cable, or a faulty output on one of the components within the AV rack.

The time frame for upgrading the Senate Chambers audio system should be between two to three years.

Proposed New System Overview

Like the House Chambers proposed network-based solution, similar or identical components would be used to upgrade the Senate Chambers. A network-based audio and control system would be the most beneficial system that could replace the existing analog system.

There are numerous floor boxes on the Senate Chambers floor that already contain network ports. Installing network-enabled audio interface boxes at the desks would allow for many conveniences not possible with the existing analog system. And because the cabling is “signal agnostic”, these same drops could be used to support video interface boxes if this capability was desired at any time in the future.

The aspects of the system comprising this solution are listed in more detail in the following paragraphs.

Audio System

In order to minimize wiring, improve system diagnostics and to maximize future flexibility of the system, we recommend that the audio system be based on a modern, configurable audio DSP with advanced audio networking capabilities. The audio processor should be installed either at the local AV rack or the nearest IDF rack (location based on where the existing network drops terminate into the network switch) and would provide all processing and distribution capabilities to the system. The audio system should include audio recording and archival capabilities, as well as provide accommodations for assistive listening to be provided to the hearing impaired.

Ideally, the existing microphones would be replaced with low-profile boundary microphones that would be flush mounted with the top of the desk. This would require a 0.75” hole to be drilled into the desk in order to secure the microphone into the desktop.

Proposed Low-Profile Boundary Microphone Location

A PoE audio interface using AES67, QLAN and/or Dante audio networking technology (compatible with the audio DSP) could be located at every other Member position. A single CAT6 cable would then provide the connectivity required for each microphone back to a network switch at the rack. This

solution provides greater flexibility with the configuration of the system, allowing future expansion of additional microphones and loudspeakers if desired. Alternatively, a single microphone cable could be used between the audio DSP at the AV rack and each desk location if the PoE audio interface is not desired.

One digital wireless microphone system that includes a lapel and handheld microphone would be available for Senate Members. The wireless microphones would have a sufficient transmitter range that covers the entire room.

Should the addition of sound reinforcement be desired in the future, the use of the networked audio interface component would support connection to a local loudspeaker, thereby maintaining connectivity back to the rack using a single CAT6 cable per location. These small desktop loudspeakers could be installed at any of the Member desks as well as at the Secretary's desk and President's Podium. The size of each desktop loudspeaker would be approximately a 5" cube with a slope on the front side.

Example Desktop Loudspeaker

An assistive listening system should be provided. In order to avoid additional visual elements and to minimize infrastructure work, we recommend the use of an RF-based system that can be installed at the AV wall rack location to provide coverage to the entire Chamber. A complement of head set receivers as well as neck loops (for use in conjunction with hearing aids) should be included for Members and other attendees to use.

Audio recording and streaming of Senate Chambers legislative sessions is covered in the *Recording, Archival, and Streaming Services System* section.

To support audio feeds for the Press in the balcony, new cabling from the wall-mounted AV rack to new XLR jacks beneath the balcony seats should be installed. Alternatively, a network-based audio interface with line-level outputs could be used in the balcony if a network drop was available in this location.

Bell System

The existing interface panel should be replaced with a networked interface panel. This panel would be programmed to perform the same functions as the existing bell system, and can be programmed for additional functions. The large touch panel (see *Control System* section below) could also be used to support interaction with the Bell System.

Control System

One large touch panel should be custom programmed with functions that allow the user to easily control all audio and video aspects of the room. This would include, but not be limited to, microphone level control, loudspeaker volume control (if added), presets, video source selection and routing, remote audio recording functions, and bell system interaction. Security precautions should be heavily considered when programming the control operations of this room to ensure that the recordings of any session are kept local and not distributed to any overflow areas unless authorized personnel use a multi-step process that would allow for this option. In addition, considerations should be made to avoid unauthorized tampering or adjustment of the system.

Infrastructure Requirements

The AV renovation and upgrades should have a minimal impact to the architecture of the space and minimize any infrastructure or construction requirements. The following section summarizes infrastructure items that would need to be considered for the new AV systems:

1. Cable Paths:
    a. Desks: Cable paths exist to all desks and would be utilized. If the existing microphones are replaced with new gooseneck microphones, the existing wiring pathway should be reused. For a networked solution, existing network jacks can be used. One network cable will be required per desk which should replace the existing microphone audio cable.
    b. Balcony: It is unknown if a cable path exists from the main rack location to the upper balcony box. To support press feeds, a cable pathway would be necessary or a network drop would be required at this location.
2. Equipment Rack: The existing location of the wall-mounted equipment rack can be reused. At least one network drop would be required. Considering that the existing network drops home run to the IT IDF closet, supporting AV equipment could also reside at that location.

CEDAR CREEK ROOM

The audio and video systems for the Cedar Creek Room shall be designed to complement the architectural design of the space. The AV support for this room will be for special events, receptions and overflow functions.

Current System Overview

Video Presentation

There are no video systems currently deployed in this room.

Audio System

The current audio system consists of a lectern outfitted with a built-in Public Address (PA) system. The top of the lectern has a gooseneck microphone that is fed into an integrated mixer/amplifier. A loudspeaker is mounted to the front of the lectern, located behind a grill cloth fixed to the lectern.

Control System

There is no control system for the Cedar Creek Room.

AV Equipment Rack

The lectern houses the PA system.

The AV equipment supporting the Cedar Creek Room is listed in the following table.

Table 1.3 – Cedar Creek Room Existing AV Equipment

Location	Description	Manufacturer	Model Number	Quantity
Podium	PA System	Oklahoma Sound Corp.	Series 100	1

Suitability for Future Expansion

The PA equipment within the lectern is a self-contained system, and therefore cannot be expanded.

Practicality of Continued Maintenance

There is little maintenance associated with the lectern and associated PA equipment.

Failure Forecast

Based on the age of the lectern, it is unlikely that the manufacturer would still support any components that might be needed to repair the PA system if it were to stop working. It is possible that the lectern/PA system would continue to work for many years to come.

With the Cedar Creek Room primarily used for receptions, special events and overflow functions, the time frame to complete this work should be between one year and five years.

Proposed New System Overview

Considering that the Cedar Creek Room can be used for multiple purposes, and that there is not a need to have a permanent AV system within this room, the proposed new system would consist of a mobile cart outfitted with a flat panel display, wireless video content gateway, a network-based video encoder and decoder, a wireless microphone system, display-mounted loudspeakers, and a small touch panel. This type of system would be capable of supporting local functions as well as be used to support overflow feeds from other rooms. Each system component is listed in more detail in the following paragraphs.

Video Presentation

A mobile cart with casters should support a large format display supporting at least full HD resolutions, and preferably 4K resolutions. A networked video system based on IP video distribution technology is recommended as it would allow flexibility in locating the mobile cart to any location in the room that has a network drop.

Example of ADA Compliant Flat Panel Mobile Cart

Inputs to the flat panel display should include a permanent, wired video input at the mobile cart (for a laptop, DVD player, or Blu-ray player), a portable video source interface to be used at network locations in the room, and a wireless video gateway allowing computer video to be sent to the display using a USB dongle on a laptop or similar device.

Audio System

The audio system on the mobile cart should consist of a wireless microphone system, a networked audio input/output component, and side or rear-mounted flat panel display speakers. Alternatively, a pair of pole-mounted loudspeakers and external amplifier could be used to offer audio that would provide better fidelity than the side or rear-mounted flat panel display loudspeakers.

The networked audio input/output component should utilize AES67, QLAN and/or Dante audio networking technology, and be compatible with the other audio DSPs used throughout the Capitol complex. By incorporating this device into the mobile equipment rack, audio feeds from any other room that also use a network-based audio interface would allow individuals to listen to that room from the Cedar Creek Room.

Control System

One small touch panel, located on the back of the mobile cart, should be custom programmed with functions that allow the user to easily control desired audio and video functionality for the room. This would include, but is not limited to, microphone level control, speaker volume control, video source selection and routing, and AV overflow options.

Infrastructure Requirements

The following section summarizes infrastructure items that would need to be considered for the mobile AV system:

1 Wall panels: Existing network jacks would be used. One network cable would be required to connect to a small network switch at the mobile cart.

2 Mobile Equipment Rack: All of the AV equipment should be mounted to the mobile cart.

CAFETERIA

The audio and video systems for the Cafeteria shall be designed to complement the architectural design of the space, while satisfying the functional requirements of the State of Vermont meeting and event functions.

Current System Overview

Video Presentation

There are no permanently installed video systems in this room. State Capitol personnel indicated that when video is required in the Cafeteria, a portable screen and projector are used.

Audio System

The current audio system consists of a lectern outfitted with a built-in Public Address (PA) system. The top of the lectern has a gooseneck microphone that is fed into an integrated mixer/amplifier. A loudspeaker is mounted to the front of the lectern, located behind a grill cloth fixed to the lectern. In addition, one XLR input is available on the west wall. This input can be used to transmit audio to the ceiling loudspeakers. The ceiling loudspeakers are only present in the main dining area, and there are no loudspeakers in the adjacent areas to the north and south of the main dining room.

Control System

There is no control system for the Cafeteria.

AV Equipment Rack

A small closet with wall shelving houses the AV equipment.

The AV equipment utilized by the Cafeteria is listed in the following table.

Table 1.4 – Cafeteria Existing AV Equipment

Location	Description	Manufacturer	Model Number	Quantity
Podium	PA System	Oklahoma Sound Corp.	Series 100	1
	Handheld Microphone	Radio Shack	RS 33-3018	1
Storage Closet	PA Amplifier	Pyle Pro	PT 210	1
	Mixer Amplifier	TOA	A-912MK2	1
	Speaker Level Input Interface	RDL	TX-70A	2
Ceiling	Loudspeakers	Unknown	Unknown	6

Suitability for Future Expansion

The PA equipment within the lectern is a self-contained system, and can connect to the local ceiling loudspeakers via the XLR wall panel. The existing system allows for minimal expansion, as the current equipment consists of only a couple of audio components that have limited inputs and outputs.

Practicality of Continued Maintenance

There is little maintenance associated with the lectern and associated PA equipment. However, State Capitol personnel stated that the electronic equipment that is used in the Cafeteria interferes with the operation of the Bell System. The TOA A912-MK2 mixer/amplifier must be turned off in order for the Bell System to operate. If local room functionality is desired, the mixer/amplifier is turned on, but then the Bell System no longer operates in this mode. The Systems Integrator that installed this portion of the AV system might be able to diagnose the cause of this problem.

Failure Forecast

Considering the age of the podium, it is unlikely that the manufacturer would still support any components that might be needed to repair the PA system if it were to stop working. It is possible that the lectern/PA system would continue to work for many years to come.

The equipment in the small closet could readily be replaced with something similar if one of the components ends up failing. The components in the closet are likely to continue working for many years.

Due to the nature of using the Cafeteria for multiple purposes, and considering the limitations of the existing system, we would suggest a time frame of one to two years to implement a new system.

Proposed New System Overview

The Cafeteria will be used for multiple purposes, to include local presentations and the option for overflow capabilities.

Each aspect of the new system is listed in more detail in the following paragraphs.

Video Presentation

Although the installation of a ceiling-mounted electric screen and projector was suggested, this solution would not produce favorable results when video would be projected onto the screen. The large skylight in the vicinity of the proposed projection screen wall allows ample sunlight into the room, and if a video presentation was desired during a time of day in which the sunlight floods this wall, the resulting projected video image would be too washed out to see any detailed information. Therefore, it is suggested that a mobile cart outfitted with a large flat panel display, supporting at least full HD resolutions, and preferably 4K resolutions, be utilized. For other locations within the dining areas that have poor line-of-sight to the main video display location, two or three additional video carts could be used.

A networked video system receiver, based on IP video distribution technology, is required for each flat panel display, as it would allow flexibility in locating the mobile video display carts to any location in the room that has a network drop. In addition, the networked video system receiver would allow a video stream from any other room in the building that utilized a compatible networked video system transmitter to be viewed on the displays in the Cafeteria. Additional network drops would be necessary for areas deemed to have poor line-of-sight to the main display viewing location (west wall) that do not currently have a network drop.

Inputs should include a wired video input at a new lectern (for a laptop, DVD player, or Blu-ray player) to a networked video system transmitter.

Audio System

The audio system should consist of at least one wireless microphone system, a fixed microphone on the lectern, a dedicated audio DSP controller, an amplifier, and a sufficient number of loudspeakers to allow for audio intelligibility throughout the Cafeteria. The networked audio DSP controller should utilize AES67, QLAN and/or Dante audio networking technology, and loudspeakers should be installed in the main dining area, the north dining area and the south dining area.

Audio recording and streaming for the Cafeteria is covered in the *Recording, Archival, and Streaming Services System* section.

Main Dining Room – Suggested Loudspeaker Locations

North Dining Room – Suggested Loudspeaker Locations

South Dining Room View 1 – Suggested Loudspeaker Locations

South Dining Room View 2 – Suggested Loudspeaker Locations

Control System

One medium-sized touch panel, mounted in the new lectern, should be custom programmed with functions that allow the user to easily control desired audio and video functionality for the room. This would include, but not be limited to, microphone level control, speaker volume control, video source selection and routing, remote audio recording functions, and AV overflow options. Considerations should be made to avoid unauthorized tampering or adjustment of the system.

Infrastructure Requirements

The following section summarizes infrastructure items that would need to be considered for the Cafeteria AV system:

1 Cable Paths:

   a. Lectern and Video Display Locations: Network connectivity would be required at or near the location of the portable display carts. If connectivity does not exist, a new path will need to be identified to provide it.

   b. Loudspeakers: A cable path would be required to be provided at the new loudspeaker locations (north dining room, south dining room).

   c. Equipment Rack: Network connectivity would be required at the location of the AV equipment rack.

2 Loudspeaker Mounting: In addition to the cabling mentioned above, the new loudspeakers would need to be mounted in the ceiling.

3 Equipment Rack: A new wall-mounted equipment rack is suggested for the small closet.

ETHAN ALLEN ROOM

The audio and video systems for the Ethan Allen Room shall be designed to complement the architectural design of the space, while satisfying the functional requirements of the State of Vermont meetings, audio and video conferencing, and overflow support.

Current System Overview

Video Presentation

One 60” display is mounted on the south wall, and a PC is located on a desk to the right of the display. On top of the display is a USB camera that is connected to the PC. One VGA cable is at the conference table, and runs across the floor and into the VGA input of the wall plate located below the display. The PC uses both the DisplayPort and VGA outputs. The VGA output of the PC goes to the local computer monitor, and the DisplayPort cable runs into the DVI input of the wall plate.

Audio System

A microphone is installed in a hobby box with a toggle switch and LED lamp on the conference table. The output of this microphone feeds into a handheld recorder. Audio conferencing utilizes a dedicated voice conferencing unit.

Existing Microphone

Audio from the PC or laptop interface at the desk is played through the internal loudspeakers on the display.

Control System

There is *a small control panel that is wall mounted to the left of the display. Functions include display power on/off, volume control of the display, and input selection on the display*.

AV Equipment Rack

There is no AV Equipment Rack within the room.

The AV equipment utilized by the Ethan Allen Room is listed in the following table.

Table 1.5 – Ethan Allen Room Existing AV Equipment

Location	Description	Manufacturer	Model Number	Quantity
Table/Desks	Microphone	Sony	Unknown	1
	VGA Cable	Unknown	Unknown	1
	Conferencing Phone	Polycom	SoundStation 2	1
PC Desk	Handheld Recorder	Tascam	DR-05	1
	Personal Computer	Dell		1
South Wall	60" Display	Sharp	PN-E601	1
	Conferencing Camera	Logitech	V-U0028	1

Location	Description	Manufacturer	Model Number	Quantity
	2-Gang Custom Input Panel	Custom	Custom	1
	Controller	Extron	MLC 62 RS D	1

Suitability for Future Expansion

The AV equipment located in the Ethan Allen Room will support local room functions, and could accept overflow streams from other rooms by integrating additional components to support this feature. New network-based AV equipment could be integrated with the existing equipment to allow for overflow options (transmitting or receiving). If recording to a central server is required, a new network-enabled microphone could be installed.

Practicality of Continued Maintenance

Overall, the Ethan Allen Room appears to be in good working order. The system is comprised of individual components that are historically reliable for long-term use. Little to no maintenance should be needed for the continued operation of this room.

Failure Forecast

With the AV components appearing to be in good shape, the system can likely provide trouble-free operation for the next three to five years. One item that may fail sooner than later is the Sony table microphone. This is based on the fact that the microphone was custom- installed in a hobby box, and the switch, LED or microphone could fail at an undetermined time. This microphone could be replaced with a similar microphone that has a built-in toggle switch and LED light that would perform the same function as what is currently installed.

Flat panel displays typically have a life span of approximately 100,000 hours. Depending on how often the flat panel display is used in the Ethan Allen Room, it could conceivably be used for many more years to come.

Upgrades to the Ethan Allen Room are not critical at this time, and a new system should be considered for this room in two to five years.

Proposed New System Overview

The Ethan Allen Room will be used for multiple purposes, to include local presentations, audio and video conferencing, and the option for overflow capabilities.

Each aspect of the new system is listed in more detail in the following paragraphs.

Video Presentation

A new 65" interactive display supporting at least full HD resolutions, and preferably 4K resolutions, with built-in 1080p cameras, microphones, loudspeakers, and an Open Pluggable Specification (OPS) slot can essentially replace all of the existing AV equipment within the room and provide the users the same functionality but with less hassle and more functionality. This display would be used for standard presentations (via the on-board OPS computer), audio and video conferencing, as well as annotative functionality. The video conferencing would be a web-based solution (Skype, WebEx, Zoom, etc.), using the on-board OPS computer.

Example Interactive Display

A networked video system based on IP video distribution technology is recommended as it would allow both transmitting and receiving audio and video for overflow functionality.

Inputs to the system should include the OPS computer and a wireless video gateway. The new wireless gateway would allow computer video to be sent to the display using a USB dongle on a laptop or similar device, thereby eliminating the need for cabling to be run across the floor to the display

Audio System

The audio system should consist of at least one fixed table microphone capable of streaming audio via AES67, QLAN and/or Dante audio networking technology. This microphone would be used for recording meetings when audio and/or video conferencing is not required via the interactive display.

The loudspeakers built into the 65" display would be sufficient for all the applications used in this room.

Audio recording and streaming for the Ethan Allen Room is covered in the *Recording, Archival, and Streaming Services System* section. Controls for audio recording and streaming would be from either a touch panel (see *Control System* section) or from a PC connected to the network. For the Ethan Allen Room, the OPS computer could be used to interface with the server that supports these functions. Alternatively, the touch panel could also perform this function.

Control System

One medium-sized touch panel, located on the conference room table, should be custom programmed with functions that allow the user to easily control desired audio and video functionality for the room. This would include, but not be limited to, microphone level control, loudspeaker volume control, video source selection and routing, audio and video conferencing dialing, and remote audio recording functions. Considerations should be made to avoid unauthorized tampering or adjustment of the system.

Infrastructure Requirements

The following section summarizes infrastructure items that would need to be considered for the Cafeteria AV system:

1 Cable Paths:

a. Video Display/OPS Computer: Network connectivity would be required at the location of the wall-mounted video display and OPS Computer. Network ports are currently available on the wall under the existing display.

COMMITTEE ROOMS

The audio and video systems in the 22 existing Committee Rooms shall be designed to complement the architectural design of the space, while satisfying the functional requirements of the State of Vermont meetings, audio and video conferencing, and overflow support. Each of the Committee Rooms shares similar equipment and functionality, such that the following sections apply to all Committee Rooms at the Capitol.

Current System Overview

Video Presentation

The Committee Rooms incorporate ultra-short-throw projectors that are displayed onto wall-mounted white boards. A USB camera is mounted to the frame of the white board, and connects to the local PC. A PC is located on a small desk near the side wall. One VGA cable is at the conference table, and runs into a floor box. The floor box has conduit chasing above the ceiling, stubbed out near the location of the projector.

Audio System

A microphone is installed in a hobby box with a toggle switch and LED lamp on the conference table. The output of this microphone feeds into a handheld recorder. Audio conferencing utilizes a dedicated voice conferencing unit.

Existing Microphone

Audio from the PC or laptop interface at the desk is played through small loudspeakers mounted on the underside of the conference table.

Existing Loudspeakers

Control System

A hand-held remote control is used to control the ultra-short show projector.

AV Equipment Rack

There is no AV Equipment Rack within the room.

The AV equipment utilized by the Committee Room is listed in the following table.

Table 1.6 – Committee Room Existing AV Equipment

Location	Description	Manufacturer	Model Number	Quantity
Table/Desks	Microphone	Sony	Unknown	2
	VGA Cable	Unknown	Unknown	1
	Conferencing Phone	Konftel	250	1
	Loudspeakers	Unknown	Unknown	2
PC Desk	Handheld Recorder	Tascam	DR-05	1
	Personal Computer	Dell		1
Wall	Short-Throw Projector	Epson	PowerLite 480	1
	Conferencing Camera	Logitech	V-U0028	1
	White Board	Unknown	Unknown	1

Suitability for Future Expansion

The AV equipment located in each Committee Room will support local room functions only. New network-based AV equipment could be integrated with the existing equipment to allow for overflow options (transmitting or receiving). If recording to a central server is required, a new network-enabled microphone could be installed.

The ultra-short-throw projector has a native resolution of 1024x768 and a native aspect ratio of 4:3 (XGA). Supporting video inputs include Composite (RCA), S-Video, VGA (Dsub-15 pin), and HDMI. Although this projector does support an HDMI input signal, an internal scaler is required to alter the higher-resolution HDMI input signal to a lower-resolution native resolution than the projector can output. As the technology in electronic devices continues to advance, analog outputs such as VGA will no longer be supported, and only digital inputs and outputs will be supported at HD and UHD resolutions (and beyond). Any new laptop purchased today no longer has a VGA output connection available. Therefore, to support future expansion in relation to a display or a projector, the State Capitol should consider electronics that have HDMI, DisplayPort, ThunderBolt or USB-C connectors.

Practicality of Continued Maintenance

Overall, the Committee Rooms appear to be in good working order. The systems are comprised of individual components that are historically reliable for long-term use. Little to no maintenance should be needed for the continued operation of these rooms.

The ultra-short-throw projector will require that the projector bulb be changed at the time that either the lamp light is flashing orange or the projected image starts to deteriorate. The lamp for this projector will last an average of 2500 hours.

Failure Forecast

With the AV components appear to be in good shape, the system can likely provide trouble-free operation for the next three to five years. One item that may fail sooner than later is the Sony table microphone. This is based on the fact that the microphone was installed in a hobby box, and the switch, LED or microphone could fail at an undetermined time. This microphone could be replaced with a similar microphone that has a built-in toggle switch and LED light that would perform the same function as what is currently installed.

Upgrades to the Committee Rooms should be phased in over the next two to five years.

Proposed New System Overview

The Committee Rooms will be used for multiple purposes, to include local presentations, audio and video conferencing, and the option for overflow capabilities.

Each aspect of the new system is listed in more detail in the following paragraphs.

Video Presentation

A new 75" interactive display supporting at least full HD resolutions, and preferably 4K resolutions, with built-in 1080p cameras, microphones, loudspeakers, and an Open Pluggable Specification (OPS) slot can essentially replace all of the existing AV equipment within the room and allow the users the same functionality but with less hassle and more functionality. This display would be used for standard presentations (via the on-board OPS computer), audio and video conferencing, as well as annotative functionality. The video conferencing would be a web-based solution, using the on-board OPS computer.

Example Interactive Display

A networked video system based on IP video distribution technology is recommended as it would allow both transmitting and receiving audio and video for overflow functionality. Inputs to the system should include the OPS computer and a wireless video gateway allowing computer video to be sent to the display using a USB dongle on a laptop or similar device.

Audio System

The audio system should consist of at least one fixed table microphone capable of streaming audio via AES67, QLAN and/or Dante audio networking technology. This microphone would be used for recording meetings when audio and/or video conferencing is not required via the interactive display.

The loudspeakers built into the 75" display would be sufficient for all the applications used in this room.

Audio recording and streaming for the Committee Rooms is covered in the *Recording, Archival, and Streaming Services System* section. Controls for audio recording and streaming would be from either a touch panel (see *Control System* section) or from a PC connected to the network. For the Committee Rooms, the OPS computer could be used to interface with the server that supports these functions. Alternatively, the touch panel could also perform this function.

Control System

One medium-sized touch panel, located on the Committee Room table, should be custom programmed with functions that allow the user to easily control desired audio and video functionality for the room. This would include, but not be limited to, microphone level control, speaker volume control, video source selection and routing, audio and video conferencing dialing, and remote audio recording functions. Considerations should be made to avoid unauthorized tampering or adjustment of the system.

Infrastructure Requirements

The following section summarizes infrastructure items that would need to be considered for the Cafeteria AV system:

1 Cable Paths:

a. Video Display/OPS Computer Location: Network connectivity would be required at the location of the wall-mounted video display.

b. OPS Computer: Network connectivity would be required at the location of the wall-mounted video display.

c. Table microphone: Network connectivity would be required in close proximity to the table microphone (under the table or at the floor).

MEETING ROOM 10

The audio and video systems for Meeting Room 10 shall be designed to complement the architectural design of the space, while satisfying the functional requirements of the State of Vermont meetings, hearings, events, and overflow support.

Current System Overview

Video Presentation

One 60” display on a mobile cart is used for video presentations in Meeting Room 10. A VGA cable is located at one of the movable conference tables, and can run across the floor into the 60” display. A laptop or similar device can use the VGA cable to display content to the 60” display.

Audio System

Five gooseneck microphones are used on the movable tables. The microphones are fed into a mixer/amplifier located in a credenza on the South wall. The output of the mixer/amplifier goes to both a compact loudspeaker located in one window well, and a small bookshelf loudspeaker located in another window well. A hearing assistance FM transmitter is located in the rack.

Audio conferencing utilizes a dedicated voice conferencing unit.

Audio from a laptop connection can be played either through the 60” display’s loudspeakers, or run through the mixer/amplifier to the two loudspeakers.

Control System

A handheld remote control is used to control the 60” display. The mixer/amplifier requires manual operation to control microphone levels and loudspeaker volume levels.

AV Equipment Rack

The AV equipment sits on a shelf in the credenza.

The AV equipment utilized by the Committee Room is listed in the following table.

Table 1.7 – Meeting Room 10 Existing AV Equipment

Location	Description	Manufacturer	Model Number	Quantity
Desks	Gooseneck Microphones	CAD Audio	Astatic 920B	5
	Microphone Splitter/Combiner	ARTcessories	SPLITComPro	1
	Conferencing Phone	Polycom	SoundStation 2	1
Cabinet AV Storage	I/O Panel	Custom	Custom	1
	Mixer/Amplifier	TOA	A-503A	1
	FM Transmitter	Audio Technica	Personal PA FM	1
Secretary Desk	Handheld Recorder	Tascam	DR-05	1
	Personal Computer	Dell	Unknown	1
Mobile Cart	60" Display	Sharp	PN-E601	1
Window	Compact Loudspeaker	Bose	L1	1
	Bookshelf Loudspeaker	Optimus	Unknown	1
Floor	Baseboard Raceway - XLR-M Jacks	Custom	Custom	1
	Baseboard Raceway - XLR-F Jacks	Custom	Custom	1
	Baseboard Raceway - CAT5/6 Ports	Custom	Custom	6

Suitability for Future Expansion

The AV equipment located in Meeting Room 10 will support local room functions only. New network-based AV equipment could be integrated with the existing equipment on a limited basis to allow for overflow options (transmitting or receiving). Audio recording to a central server would require new network-enabled microphones.

Practicality of Continued Maintenance

The AV equipment in Meeting Room 10 appears to be in decent working order. The 60" flat panel display will require little to no maintenance. The gooseneck microphones will likely require no maintenance for the foreseeable future. Overall, the equipment in this room will require minimal maintenance.

Failure Forecast

Most of the AV components appear to be in good shape, and most of the components in the system can likely provide trouble-free operation for the next three to five years. The one exception to this statement is that when audio is recorded to the handheld device, the recording contains hiss and noise. This would indicate that there is a wiring issue, ground loop problem, or a faulty piece of equipment somewhere in the audio chain. It is suggested that a thorough assessment of the existing audio system be performed by a qualified technician to find and fix this issue.

Flat panel displays typically have a life span of approximately 100,000 hours. Depending on how often the flat panel display is used in Meeting Room 10, it could conceivably be used for many more years to come.

With Meeting Room 10 supporting numerous functions, it is suggested that the proposed new system be installed within the next one to two years.

Proposed New System Overview

Meeting Room 10 will be used for multiple purposes, to include local presentations, meetings, hearings, events, and the option for overflow capabilities.

Each system component is listed in more detail in the following paragraphs.

Video Presentation

A mobile cart with casters would containing a large format display supporting at least full HD resolutions, and preferably 4K resolutions. A networked video system based on IP video distribution technology is recommended, as it would allow flexibility in locating the mobile cart in any location in the room that has a network drop.

Example of ADA Compliant Flat Panel Mobile Cart

Inputs to the flat panel display should include a permanent wired video input at the mobile cart (for a laptop, DVD player, or Blu-ray player), a portable video source interface to be used at network locations in the room, and a wireless video gateway allowing computer video to be sent to the display using a USB dongle on a laptop or similar device.

Audio System

Meeting Room 10 requires that the tables can be set up in numerous configurations. Therefore, the microphones used within the room should support the flexible nature of different table arrangements. We recommend that the existing microphones be replaced with a network-based wireless microphone system including gooseneck transmitters, a transceiver capable of handling up to eight microphone transmitters, an audio network interface, and appropriate charging station(s). In addition, one wireless handheld microphone is suggested. New equipment should be mounted in a new equipment rack that has a furniture finish. An example is shown in the *Infrastructure Requirements* section.

The audio system should consist of a dedicated configurable audio DSP, an amplifier, and a minimum of two wall- or pole-mounted loudspeakers to allow for audio intelligibility throughout the room. The audio DSP controller should support AES67, QLAN and/or Dante audio networking technology. The DSP controller and the amplifier should be mounted in a new equipment rack.

Audio recording and streaming for the Meeting Room 10 is covered in the *Recording, Archival, and Streaming Services System* section. Controls for audio recording and streaming would be from either a touch panel (see *Control System* section) or from a PC connected to the network.

Control System

One medium-sized touch panel, located at the top of the equipment rack, should be custom programmed with functions that allow the user to easily control desired audio and video functionality for the room. This would include, but not be limited to, microphone level control, speaker volume control, video source selection and routing, and remote audio recording functions. Considerations should be made to avoid unauthorized tampering or adjustment of the system.

Infrastructure Requirements

The following section summarizes infrastructure items that would need to be considered for the Meeting Room 10 AV system:

1 Cable Paths:

   a. Video Display Locations: Network connectivity would be required at or near the location of the portable display cart. The perimeter of the room is outfitted with a removable metal baseboard that currently contains data and power drops. Additional connections can easily be installed in the metal baseboard for AV connectivity support.

   b. Loudspeakers: A cable path would be required at the new loudspeaker locations, should a permanently-mounted solution be desired.

   c. Equipment Rack Location: Network connectivity would be required near the equipment rack.

2 Loudspeaker Mounting: In addition to the cabling mentioned above, permanently-mounted loudspeakers would need to be either wall-mounted or pole-mounted.

3 Equipment Rack: A new elegant furniture rack supporting AV equipment is suggested for the small room, as the existing credenza may not be able to support the quantity of items required nor the depth of the new equipment.

Example of a Furniture Rack

MEETING ROOM 11

The audio and video systems for the Meeting Room 11 shall be designed to complement the architectural design of the space, while satisfying the functional requirements of the State of Vermont meetings, hearings, events, and overflow support.

Current System Overview

Video Presentation

There are no permanently installed video systems for Meeting Room 11. State Capitol personnel indicated that when video is required in this room, one or more portable screen(s) and projector(s) are used.

Audio System

Six gooseneck microphones are used on the movable tables. The microphones are plugged into XLR jacks along the metal baseboard surrounding the room. In turn, the XLR cables feed into a custom microphone mixing box located on a shelf in the closet. The microphone mixing box is then connected into the mixer/amplifier. The output of the mixer/amplifier goes to eight ceiling loudspeakers.

A lectern outfitted with a built-in Public Address (PA) system is in the room. The top of the lectern has a gooseneck microphone that is fed into an integrated mixer/amplifier. A loudspeaker is mounted to the front of the lectern, located behind a grill cloth fixed to the lectern.

Audio conferencing utilizes a dedicated voice conferencing unit that is completely stand-alone from the room audio system.

An induction loop assisted listening system is installed within the room. It is not clear if this system is still active or functional.

Control System

Handheld remote controls are used to control the portable projectors.

AV Equipment Rack

The AV equipment sits on a couple of shelves in the closet on the South wall.

The AV equipment utilized by the Committee Room is listed in the following table.

Table 1.8 – Meeting Room 11 Existing AV Equipment

Location	Description	Manufacturer	Model Number	Quantity
Desks	Gooseneck Microphones	CAD Audio	Astatic 920B	6
	Microphone Splitter/Combiner	ARTcessories	SPLITComPro	1
	Conferencing Phone	Polycom	SoundStation 2	1
Closet AV Storage	Mic Combiner/Switcher	Custom	Custom	1
	In-Line Mic-Level Isolation Transformer	RapcoHorizon	ISOBLOX	1
	Mixer/Amplifier	TOA	A-912MK2	1
	Induction Loop Assistive Listening System	Oval Window Audio	Satellite II	1
Secretary Desk	Handheld Recorder	Tascam	DR-05	1
	Personal Computer	Dell		1
Ceiling	6" Ceiling Speakers	Unknown	Unknown	8
Podium	PA System	Oklahoma Sound Corp.	Series 100	1
Floor	Baseboard Raceway - 1/4" Hearing Assist Jacks	Custom	Custom	6
	Baseboard Raceway - XLR-M Jacks	Custom	Custom	1
	Baseboard Raceway - XLR-F Jacks	Custom	Custom	6
	Baseboard Raceway - CAT5/6 Ports	Custom	Custom	9

Suitability for Future Expansion

The AV equipment located in Meeting Room 11 will support local room functions only, though new network-based AV equipment could be integrated with the existing equipment on a limited basis to allow for overflow options (transmitting or receiving). If recording to a central server is required, new network-enabled microphones could be installed.

Practicality of Continued Maintenance

The AV equipment in Meeting Room 11 appears to be in decent working order. The type of portable projectors and manual screens were not evaluated during the site visit, and therefore cannot be commented on. The gooseneck microphones will likely require no maintenance for the foreseeable future. Overall, the equipment in this room will require minimal maintenance.

Failure Forecast

Due to not knowing the internal components used for the custom microphone mixer box, it is difficult to determine how long this box will continue to work. The microphones and mixer/amplifier are in reasonably good condition, and should continue to operate reliably for three to five years.

With Meeting Room 11 supporting numerous functions, it is suggested that the proposed new system be installed within the next one to two years.

Proposed New System Overview

Meeting Room 11 will be used for multiple purposes, to include local presentations, meetings, hearings, events, and the option for overflow capabilities.

Each aspect of the new system is listed in more detail in the following paragraphs.

Video Presentation

Multiple mobile carts with casters should support a large format display supporting at least full HD resolutions, and preferably 4K resolutions. A networked video system based on IP video distribution technology is recommended for each cart, as it would allow flexibility in locating the mobile cart to any location in the room that has a network drop.

Example of ADA Compliant Flat Panel Mobile Cart

Inputs to the flat panel displays should include a permanently wired video input at the mobile cart (for a laptop, DVD player, or Blu-ray player), a portable video source interface to be used at network locations in the room, and a wireless video gateway allowing computer video to be sent to the display using a USB dongle attached took a laptop or similar device.

Audio System

Meeting Room 11 requires that the tables can be set up in numerous configurations. Therefore, the microphones used within the room should support the flexible nature of different table arrangements. We recommend that the existing gooseneck microphones be replaced with between eight and twelve wireless gooseneck transmitters, transceivers capable of handling up to twelve wireless microphones, audio network interfaces, and applicable network charging station(s). In addition, one wireless handheld microphone is suggested.

The audio system should also consist a new FM-based hearing assist system, a dedicated configurable audio DSP, an amplifier, and eight new ceiling-mounted loudspeakers mounted in the same location as the existing loudspeakers. The audio DSP should support AES67, QLAN and/or Dante audio networking technology.

Audio recording and streaming for the Meeting Room 11 is covered in the *Recording, Archival, and Streaming Services System* section. Controls for audio recording and streaming would be from either a touch panel (see *Control System* section) or from a PC connected to the network.

Control System

One medium-sized touch panel, located either in the AV closet, or at one of the conference room tables, should be custom programmed with functions that allow the user to easily control desired audio and video functionality for the room. This would include, but not be limited to, microphone level control, speaker volume control, flat panel display control, video source selection and routing,

and remote audio recording functions. Considerations should be made to avoid unauthorized tampering or adjustment of the system.

Infrastructure Requirements

The following section summarizes infrastructure items that would need to be considered for the Meeting Room 11 AV system:

1 Cable Paths:

   a. Video Display Locations: Network connectivity would be required at or near the location of the portable display cart. The perimeter of the room is outfitted with a removable metal baseboard that currently contains data and power drops. Additional connections can be easily installed in the metal baseboard for AV connectivity support.

   b. Loudspeakers: A cable path would be required between the AV closet and the ceiling loudspeaker locations. The existing conduit/conveyance should suffice.

   c. Equipment Rack Location: Network connectivity would be required near the equipment rack.

2 Loudspeaker Mounting: In addition to the cabling mentioned above, the new loudspeakers would need to be ceiling-mounted. Due to the fact that these would be replacing the existing loudspeakers, minimal effort should be required.

3 Equipment Rack: An equipment rack that can fit inside the existing AV closet is suggested.

BELL SYSTEM/EMERGENCY PUBLIC ADDRESS SYSTEM

The new Bell System shall be designed to complement the architectural design of the building, while satisfying the functional requirements of the State of Vermont alert system.

Current System Overview

The Bell System is installed throughout the State Capitol building including in the Cedar Creek Room, Cafeteria, Ethan Allen Room, all the Committee Rooms, Multipurpose Room 10 and Multipurpose Room 11, as well as select offices. There is one Call Switch panel in both the House Chambers and Senate Chambers, allowing the House Clerk and Senate Secretary to alert Members that session is about to begin in one of the Chambers.

The existing Bell panels located throughout the building are mounted on a 2-gang/four square external box, and have two indicator lights – red for the House and green for the Senate. In addition, an audible chime will play through an internal hidden loudspeaker when one of the Call Switch panels is activated. The loudspeaker can also be used for voice address through a telephone connection.

Existing Bell System Panel

Equipment for the Bell System is located in the west basement Computer Room/MDF.

Suitability for Future Expansion

The existing Bell System was custom designed by a local AV integrator, and has been functional for over 20 years. The electronics and other components used to manufacture the alert panels may or may not be readily available if additional alert panels were desired by the State Capitol. The Bell panels can support only two different colored lights, whereas newer panels can support just about any color that is desired. The option of including a Talkback microphone within the existing Bell panel is not an option, but could be integrated into a new panel.

Practicality of Continued Maintenance

The Bell System appears to be in good working order. Potential components that may need to be serviced inside the Bell panels include the loudspeakers and light bulbs. However, given that the Call Switch panels and the Bell panels have not had any component failures, it is believed that the Bell System would require little to no maintenance for the foreseeable future.

Failure Forecast

The west basement Computer Room/MDF room houses the custom control panel and four amplifiers that interface with the Call Switch panels and Bell panels. Should one of the amplifiers fail, it could easily be replaced with a similar amplifier. The one item that could not be replaced is the custom control panel itself. If a component on the custom control panel failed, a qualified electronics technician could potentially get it operational again. Although the Bell System has been operational for more than twenty years, there is no external indication that it will fail anytime soon.

While the existing Bell System is limited in functionality when compared to what is available with current technology, the system appears to still support the minimal needs for the building. The prime concern is related to the age of the existing system, and the custom control panel that is a critical component for functionality. A new Bell System/Emergency Public Address System should be considered within the next two to three years.

Proposed New System Overview

A modernized Bell System would allow the Bell panels to be PoE network-enabled devices. Features of a new system would include the same functionality as what currently exists, as well as numerous options that could include the following:

- Substantially reduced footprint in MDF for supporting equipment
- Use as a public address system
- Selectively page individual rooms, multiple rooms, or custom groups using any telephone within the building (both POTS and VoIP platforms are supported)
- Ability to be utilized for emergency alerts, active shooter notifications, etc.
- Option of having an LCD display, LED flashers, loudspeaker, and paging microphone built into a single device

Infrastructure Requirements

The following section summarizes infrastructure items that would need to be considered for the Bell System:

1 Cable Paths:

   a. Call Switch locations: Network connectivity would be required at the location of both the House and Senate Call Switch.

   b. Bell Panel locations: Network connectivity would be required for all of the wall-mounted Bell Panels.

2 Equipment Rack Space:

   a. 2RU of rack space would be required for the controller in the MDF room.

   b. 2RU of rack space would be required for the PoE+ network switch required to interface with all of the Bell panels

Legislative Session Loudspeaker Distribution

A loudspeaker distribution system shall be designed to broadcast live audio from either the House or Senate Chambers to offices and rooms throughout the building.

Current System Overview

Numerous offices and rooms in both the State House and 1 Baldwin Street have a single loudspeaker that has been modified to include a rotary selector knob and a volume control. The rotary selector knob is used to switch between audio being fed from the House or Senate Chambers.

Suitability for Future Expansion

The loudspeakers run off a 70V amplifier system. Additional custom-modified loudspeakers could be added in a parallel to support additional rooms; however, it didn't appear that additional loudspeakers were required in any other areas in either building.

Practicality of Continued Maintenance

There is little to no maintenance in supporting the Legislative Session Loudspeaker Distribution System. If one of the existing amplifiers fails, another off-the-shelf amplifier could be purchased to replace it. The loudspeakers consist of numerous makes and models, but the internal components in each one will be very similar. If any maintenance is required for one of the loudspeakers, a qualified electronics technician would likely be able to repair or replace the necessary components to make the loudspeaker operational.

Maintenance on the amplifier should include cleaning vents of any dust/debris on a regular basis (every six months to one year).

Failure Forecast

This system has been in place for many years. The loudspeakers are used at low volume levels, and therefore the drivers should be in good shape. The rotary selector knob and volume controller are simple components that should continue to work for many years to come.

The 70V amplifiers used to power the loudspeakers should last for at least another three to five years so long as they are serviced.

Proposed New System Overview

The most practical and least expensive option to upgrade the Legislative Session Loudspeaker Distribution system would be to take advantage of equipment that is already in place. If the computers that are used by the State House employees all have computer loudspeakers connected to them, there are two solutions available.

The first solution would be a simple computer program would be installed that allows audio to traverse over the network, be decoded by a “virtual sound card”, and then played through the local PC’s loudspeakers. This simple configuration would allow State House employees to listen to any audio that resides on the network, provided that other rooms have been upgraded to support networked digital audio technologies.

The second solution would utilize the streaming server to distribute audio to computers and/or mobile devices. State House personnel would simply launch a web-based program guide on the device and start streaming the audio.

Infrastructure Requirements

The following section summarizes infrastructure items that would need to be considered for the Legislative System Loudspeaker Distribution:

1 State House employee PCs: Network connectivity would be required at each computer that supported the use of a virtual sound card or web-based interface.

Recording, Archival, and Streaming Services System

A recording, archival, and streaming services system shall be designed to support the capture and distribution of live audio sessions, as desired, in the House, Senate, Ethan Allen Room, Cafeteria, Committee Rooms and Public Meeting Rooms 10 and 11.

Current System Overview

The rooms that require live audio to be recorded are currently using a handheld recorder to perform this function. Depending on the size of the room, microphones are either first sent into a mixer whose output feeds into a handheld recorder, or directly into a handheld recorder. An individual must manually tend to the transport functions (stop, record, play, etc.) of the recorder. Once a recording has been completed, the individual transfers the digital audio file to the appropriate computer for archival purposes. In some instances, a recordable CD is used to create an additional backup of the recording.

Practicality of Continued Maintenance

The handheld recorders that are currently in use are reasonably new, and will likely not require any maintenance other than changing batteries.

Failure Forecast

The handheld recorders should operate for another eight to ten years.

Proposed New System Overview

The proposed new systems utilize either DSP processors that mix all of the microphone signals together, or a single network-based microphone that would transmit the digital audio signal directly to the network. In both cases, this allows audio from any room capable of network-based audio to be distributed across the entire network. Once this audio is on the network, it could be used to support multiple needs of the State House. Individuals could stream live audio directly to their computer or mobile device with ease. Meetings or legislative sessions could easily be scheduled to be recorded or streamed. All recordings would reside in one central location, making archival and retrieval simple and convenient.

We recommend that a hybrid system comprised of an on-premises server and a cloud-based service platform be implemented for recording, streaming, indexing and archival of audio and video. AV capture hardware (encoders) and application servers would be located in the MDF room, while scalable cloud services would be used to manage all aspects of recording, indexing, archiving, streaming, and providing on-demand content to users. This platform should support the industry standard AAC/H.264 format, ensuring delivery of content to both mobile and fixed devices. The

system should support audio-only, video-only, or audio and video content. The system should also be scalable to support small configurations or large operations.

Interfacing with the Recording, Archival, and Streaming Services System would be accomplished with a standard PC using a web-based login. The platform should allow for multiple log-ins with varying levels of administrative permissions.

The user interface would be as simple as logging onto a web-based platform from any PC and setting up a schedule for recording, streaming or archiving. The system should also support loop-recording, which records content 24/7 so that no content is lost if a recording schedule was not set up prior to a meeting or legislative session.

This system would benefit the State House by centralizing numerous operations onto one system for recording, archiving, streaming and on-demand content.

Using this platform would require recurring month-to-month expenses with the company that provides these services.

The implementation of this proposed new system assumes that other rooms within the building have been updated to support networked digital audio and video technologies.

Infrastructure Requirements

The following section summarizes infrastructure items that will need to be considered for the Recording, Archival, and Streaming Services System:

1 Cable Paths:

   a. Rooms: Network connectivity requirements was covered for each room that supports audio recording and archival functions.

2 Equipment Rack Space:

   a. 4RU of rack space would be required for the hardware encoders and server in the MDF room.

Creation of Design Documents:

Two options are available for project delivery. Each one is described below.

The Design-Build method contracts a single entity that would coordinate with the owner/owner's representative to design the AV systems, procure all the necessary equipment for the project, install the systems, program and commission the systems, and train the owner/owner's representative on the operation of the rooms. The owner works closely with this entity to determine the schedule for installation completion.

The Design-Bid-Build method contracts with multiple entities to realize the design and construction of a project. In the Design Phase, the owner or owner's representative works with a consulting firm on all aspects of the AV objectives. Understanding the needs from the owner/owner's representative, the consulting firm would generate a complete bid package to include functional drawings, construction drawings, technical specifications and detailed equipment lists. Once the bid documents are completed, Request for Proposal (RFP) invitations would be issued in the Bid Phase to prospective AV integrators. AV integrators interested in the project would submit their bids by the stated deadline contained in the bid documents. For the Proposal Evaluation/Review Phase, the owner/owner's representative would review each bid package to determine which company is best suited to perform the AV Construction Phase, typically based on qualifications and price. When an integrator is chosen by the owner/owner's representative to perform the work outlined in the bid documents, the project moves into the Award Phase. Next, the AV Construction Phase kicks off, in which the owner/owner's representative and AV design consultant would work with the integrator to develop a time frame for scheduling the installation of the various AV systems. During the Construction Phase, the integrator and AV consultant work closely together on the submission and review of submittal documentation. Once the submittals have been approved, the integrator begins procurement of equipment, followed by the building and testing of the system. Once the system has been commissioned by the AV consultant, demonstration and training of the system to the owner/owner's representative is conducted. The final step is the preparation of as-built documentation by the integrator. These documents then serve as the final record of the installed systems.

Under the Design-Bid-Build method, the following timeline is used as a guide for the completion of tasks:

- Design Phase: 12 weeks (assumes that designs for all systems are done simultaneously)
- RFP/Bid Phase: Can range between 4-8 weeks (depending on Vermont processes and procedures)
- Proposal Evaluation/Review Phase: 3-4 weeks
- Award Phase: Depends on Vermont processes and procedures

- AV Construction Phase: Depends on the desired implementation of prioritized rooms to be installed and the available installation dates of the State House.

AV Construction Priority and Timeline:

The following table lists each system's priority for a new AV system and the estimated installation time required for each room. The priority level for each room was determined by the age of the existing AV system, availability of replacement parts, how often the room is used, and the importance of the room. The AV Construction Timeline could vary depending on the number of installers that are deployed by the integrator, room scheduling conflicts, infrastructure requirements, and/or equipment procurement.

Room	Priority Level	AV Construction Timeline
House Chambers	Immediate	6 - 8 Weeks
Senate Chambers	Immediate to 2 years	2 - 3 Weeks
Cedar Creek Room	1 - 5 Years	1 - 2 Days
Cafeteria	Immediate to 2 years	1 Week
Ethan Allen Room	1 - 5 Years	3 Days
Legislative Committee Rooms	1 - 5 Years	3 Days (each)
Multipurpose Room 10	Immediate to 2 years	1 Week
Multipurpose Room 11	Immediate to 2 years	1 Week
Bell System/Emergency Public Address System	Immediate to 2 years	4 Weeks
Legislative Session Loudspeaker Distribution	Immediate to 2 years	1 Week
Recording, Archival and Streaming Services System	Immediate to 2 years	2 Weeks

STATEMENT OF PROBABLE COSTS

The table below outlines the estimated cost for a design-build implementation of new AV systems throughout the Vermont State House.

Room	Unit Cost per Room	Qty	Extended
House Chambers	$ 768,500.00	1	$ 768,500.00
Senate Chambers	$ 82,200.00	1	$ 82,200.00
Cedar Creek Room	$ 40,800.00	1	$ 40,800.00
Cafeteria	$ 114,500.00	1	$ 114,500.00
Ethan Allen Room	$ 31,100.00	1	$ 31,100.00
Legislative Committee Rooms	$ 34,700.00	22	$ 763,400.00
Multipurpose Room 10	$ 57,900.00	1	$ 57,900.00
Multipurpose Room 11	$ 133,000.00	1	$ 133,000.00
Bell System/Emergency Public Address System	$ 95,700.00	1	$ 95,700.00
Legislative Session Loudspeaker Distribution	$ 16,700.00	1	$ 16,700.00
Recording, Archival, and Streaming Services System	$ 18,500.00	1	$ 18,500.00
AV Systems Total			**$ 2,122,300.00***

*Does not include costs associated with any required infrastructure or architectural modifications

Estimated Ongoing Costs for Maintenance and Support of the New Systems:

Most AV systems require a certain level of support staff for operation and maintenance. The amount of support needed for a system will depend on the size and complexity of the room and what kind of functions are necessary from the AV system on a day-to-day operation. A small room, such as the Ethan Allen Room, would require very little staff support, as the room has basic functions and most individuals that walk into the room could easily pick up the remote control or interface with the touch panel and operate the room with little to no external support. Other rooms, such as the House Chambers, might require more support to ensure portable video carts are properly set up within the room prior to a session, Press members have correctly interfaced with output jacks, streaming services are active (when appropriate), etc.

Most parameters within an AV system would be programmed so that the operator only has to interface with the system for basic room control. Overall, day-to-day operations could be handled by individuals that are already familiar with the existing systems. These individuals would be trained on using the touch panels and could easily operate the new AV systems. Operations would likely be limited to turning the room on and off and making minor audio adjustments (microphone volume

control or loudspeaker volume control) when necessary. Otherwise, the AV equipment is pre-configured for audio levels, processing, routing, and communication to other AV devices.

Rooms that would require the least amount of support include the following:

- Ethan Allen Room
- Committee Rooms

The following rooms would require additional support based on the notion that portable AV carts are used in these spaces:

- Cedar Creek Room
- Cafeteria
- Multipurpose Room 10
- Multipurpose Room 11

Finally, the rooms that could require the most support, based on the importance of business conducted within the rooms, are the following:

- Senate Chamber
- House Chamber

The Bell System/Emergency Public Address System would not require day-to-day support, as it is essentially designed to be an “intuitive” system that has a small learning curve at the beginning, and then can be operated with ease.

Based on the information listed above, and assuming that no one currently fills this role, it is estimated that the State House would require one individual to fill an AV technical support position. The AV technical support role would include transporting portable video carts in and out of associated rooms based on the scheduled events for that room, setting up equipment to support overflow scenarios, creating schedules for audio recording and streaming, assist Press members with setting up their equipment, troubleshooting (video not displaying on screens, wireless microphone transmitters and receivers not communicating, help configure a web-based video conference, etc.), Bell System/Emergency Public Address System support, maintenance of AV equipment (such as cleaning dust out of amplifier chassis), and additional items related to the typical AV support that might be needed from personnel in the building.

Other Costs:

If the State of Vermont decides to update every room with a new AV system as outlined in this report, there should be very minimal other costs associated with the ongoing operation and maintenance of said systems. The new AV systems should provide the State House with years of trouble-free operation.