

# Audio Video Broadcasting at Bethlehem Lutheran Church

## Overview

The A/V setup at Bethlehem progressed from an audio only recording and archiving activity to a multi-camera livestream setup. By examining this progression, other churches can migrate from their current activities to something similar to Bethlehem's current setup. Recognize that there can be goals at two levels. First, the goal is to provide an archive of material presented during a service. Second, the goal is to provide dynamic viewing of the material presented during a service anywhere an internet connection exists.

The first goal requires either audio or audio/video recording equipment. The second goal requires an active internet connection with a high-speed upload capability and audio/video recording and encoding equipment.

We describe an easily deployable a/v solution first, followed by a higher quality system. Finally, the system currently in use, incorporates multiple cameras and a PC that injects the display of a variety of source materials.

While it is assumed that a church has an audio amplifier and mixer, the simple broadcast device below doesn't incorporate the audio output from that system. The other two systems include injecting the sound directly into the video and therefore improve the audio quality of the broadcast.

Current technology improvements also facilitate eliminating some of the individual pieces of equipment by purchasing a bundled solution for the video cameras and broadcasting encoder.

## Simple Broadcast and Archive Configuration

After recording the audio of our services and posting them on our church website, we decided to investigate live video broadcasting the service. Previously, we video recorded the service using an old VHS camcorder. The VHS tape was then given to the Pastor after the service so he could review it as he desired. The video quality of this analog VHS camcorder was poor.

So, our initial investigation of broadcasting our service LIVE, consisted of purchasing a Drop Cam. This system is now called Nest. It requires a high-speed UPLOAD internet connection. Recognize that most internet providers advertise their DOWNLOAD speeds. That's good for viewing video. What's needed is a high-speed UPLOAD connection. See Exhibit 1.

The Nest solution sets up easily and quickly. After an initial plug in to your internet router for setting up, it connects wirelessly. The very high-resolution camera can be zoomed in during the service and the audio comes from its built-in microphone. The Nest solution will handle the encoding, uploading, broadcasting and archival of the service. You simply use a local PC to activate the camera, access your Nest webpage and do the zooming dynamically during the service. Potential viewers visit the church's website, where there's an embedded link to the page on the Nest site that dynamically displays your active video broadcast. You can automatically schedule a broadcast for unattended broadcasting.

The broadcast is archived at Nest for 30 days and can be downloaded to your website for longer archival. The Nest subscription service can be shut down when you desire. You purchase the Nest camera and pay a monthly fee for the broadcast and archival.

This system worked well. Folks could view the service live on their internet connected PC, by visiting our broadcasting web page. Smart phones also could view the live service.

The downside was the limited ability to move the camera during a broadcast and the ambient sound wasn't as pure as the microphone sound available from the audio mixer.

But this inexpensive system deploys quickly.

### **Better, Single Camera Configuration**

After using the above system for about one year, we integrated a Canon HD video camera into the system. Currently, we use several Canon Vixia HF G20 cameras. These cameras feature: external microphone jack, HDMI video out, removable SD recording card and LANC remote control ability. Additionally, these cameras hold their adjusted saturation and contrast settings. See Exhibit 2.

We mounted this camera on a tall (72") tripod, connected in the audio from our sanctuary mixer, and began recording terrific audio/video on the camera's SD card. Our mixer's audio output was directly injected into the microphone input on the HF G20. This greatly improved the audio on our video broadcasts and recordings. An HDMI cable from the HF G20 connected into the Teradek Vidui Encoder. The Teradek connected via a wired connection (RJ59) to our high-speed internet.

The small LED screen on the HF G20 camera allows us to view what was being broadcast & recorded. To facilitate manipulating the HF G20, we connected a remote LANC controller that gave us the ability to zoom and start/stop recording without actually touching the camera. See Exhibit 3. Additionally, the Bescor motorized pan head mount allows us to pan and rotate the camera. See Exhibit 4.

The Teradek Vidui encoder accepts the HDMI audio/video input from the HF G20. When connected to the church's internet, the encoder broadcasts our live service. Although the Vidui encoder can operate wirelessly (on its internal battery), we use a wired internet connection and a 110v power supply for reliability. The Vidui requires an initial parameter set up, but after that, it only needs an occasional rebooting. See Exhibit 5.

After looking at many content delivery providers, we chose DaCast ([www.dacast.com](http://www.dacast.com)). They were the cheapest and most reliable that we could find. The fee is around \$19 per month. We've seen many 'church' related service providers, but most charge way too much for what they provide. YouTube also provides this service, but we wanted a reliable, simple and inexpensive provider. Recently, we switched to [www.SundayStreams.com](http://www.SundayStreams.com), primarily due to some unreliable service by DaCast. Sunday Streams is affiliated to a church body (not Lutheran) and provided outstanding support. Their fee is higher at \$49.00 per month. Either service provider should work.

### **Multi Camera Configuration**

When we built a new sanctuary, we included wiring for 4 cameras. Additionally, our design featured a dedicated PC for displaying messages and WELS connection videos on church monitors as well as across the internet. Two of the cameras were over 200 cable feet from the A/V console. A special coax cable (Serial Digital Information cable, SDI) is needed to transmit this distance. Converters to and from HDMI and SDI were needed at both ends of the SDI coax cable.

To accomplish this, we had to add ‘HDMI to SDI’ converters to the output of the HD cameras that were over 50 cable feet from the video mixer. Since the Roland video mixer only accepted HDMI input, we added ‘SDI to HDMI’ converters at the other end of the SDI cables. See Exhibit 6.

Sending High Definition video signals within a building can be via wireless cameras, SDI cable or even Cat 5 or Cat 6, PoE cables. Newer technology can make it easier to install remote cameras. Additionally, some cameras come equipped with pan and tilt mounts as well as optical zooming. It is worthwhile to investigate this newer technology. The movement to 4K resolution seems to be gaining in interest, but current HD recording at 1920x1080 still produces outstanding videos. The YouTube channel broadcasts at a maximum of 1280x720. So current HD resolution cameras seem to be suitable for several years.

The audio from the sanctuary mixer was injected into the video channel selected on the Roland for broadcasting. Recognize that with multiple cameras, the audio picked up by each camera has limited value. Instead, we only use the audio from our Sanctuary microphones. This can include microphones for the full sanctuary, pastor, choir, piano line-in and PC videos, such as the WELS connection. See Exhibit 7.

The Roland mixer only produces the video output for broadcast. Since we no longer were using just one video source, we needed a way to record the live video for our archives. To that end, we purchased another device to record the broadcast video complete with injected audio. See Exhibit 8.

Finally, since this final signal may be used for several purposes, we needed to split it. One purpose was to send to the Teradek Vidiu for broadcasting, another was for recording for our archives, another was for broadcasting onto monitors with the narthex and coffee room. So, we added an HDMI splitter, Exhibit 9.

One final note when injecting audio from a mixer, into a separate video source. The audio signal must be delayed from .03 to .10 seconds, since the video processing takes longer than audio processing. This can become apparent when you see someone’s mouth moving and the sound isn’t in sync. Our digital audio mixer handles this with ease.

## Equipment List

### Exhibit 1 Dropcam by Nest.

This device handles the ambient audio and has electronic zoom. The video resolution is good. You need a Nest account that is available on a subscriber basis. The device includes the broadcast encoder. It needs a 110-volt outlet and uses a wireless internet connection. Easy to setup and easy to use. The broadcast recordings can be downloaded for up to 30 days.



Roll over image to zoom in

Nest

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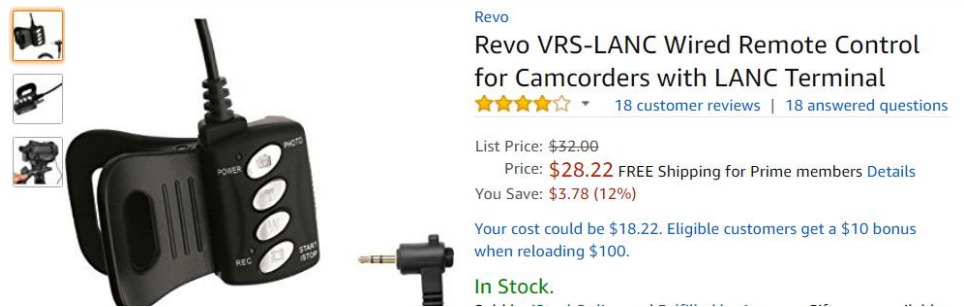
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Style: **New**

**Exhibit 2 Canon Vixia HF G20 camera, refurbished.** The criterion for selecting an HD camera include: external microphone input, HDTV output, removeable SD recording ability, external wired remote (LANC) port, and ability to enhance the video recording preset for video Saturation and Contrast. We've used many different cameras during the past decade and these cameras present a real bargain. However, as long as the criterion are met, other cameras can be used.



**Exhibit 3 LANC camera controller.** To easily activate the camera, start recording and zoom the camera, we connected a LANC controller. Not all cameras allow this wired remote connection. Specific cameras may use specific controllers. Most of the Vixia line of cameras tolerate the LANC controllers. Be sure to purchase one that matches your camera. This device makes camera adjustments easier when the camera is on a tripod. It is self powered, using the power from the camera.



**Exhibit 4 Bescor Motorized Pan Head.** This device mounted directly to the top of the tripod and the HF G20 mounted on top of it. The pan head requires 110 v and allows you to remotely adjust the aim of the camera. The Bescor adjusts the rotation horizontally, as well as vertically via a small dial. It is precise and smooth. A tripod mounted camera can be adjusted smoothly via the LANC and Bescor. You only need to view the cameras LED screen while making the adjustments. Having these motorized adjustments makes the camera movements seem smooth.



**Exhibit 5 Teradek Vidiu, video encoder.** This device accepts the HDMI audio/video signal from the camera and encodes it into a format suitable for sending to the broadcaster. This device does all the ‘heavy lifting’. No PC is needed for broadcasting. After hard coding the broadcasting parameters one time, the Vidiu will send the encoded signal to the provider you selected. We leave our broadcast live 24/7, since there is no additional charge for continuous broadcasting. The Vidiu can be configured so that simply turning it on will make all necessary connections and the broadcast will begin. If no video signal is present, a black screen will be broadcast. This device can be run from its internal battery and via a wireless internet connection, making it practical to broadcast live events using a portable camcorder. However, we use a wired internet connection and 110 v power supply. Thus, it only serves one purpose, live video of our church services.

**Exhibit 6 Roland Video Mixer.** This mixer allows switching up to 4 HDMI inputs to a single HDMI output. Various features such as fade and dissolve, and picture in picture are available, but never used. We use the Roland as a simple cut switcher. We cut from one camera (or PC display) to another. Since we’re injecting the audio from our audio amplifier/mixer, we do the audio injection after the Roland mixer. When using multiple cameras (including a PC), it’s necessary to use a separate monitor to frame each camera’s image. The Roland has an HDMI output showing all 4 inputs and another HDMI output with only the selected channel for the broadcasting. We use a separate HDTV monitor to frame the 4 cameras.

**Exhibit 7 Audio Inserter** The sound captured from each camera isn’t used. We use the full sanctuary sound, the pastor’s microphone or the PC sound. Each of those sound sources is mixed and then injected into the final displayed video. It’s this composite video and audio that is broadcast. To mix the sound with the selected video, we use a simple device. This device accepts HDMI video and the sound from our mixer. It injects the sound from our mixer with the HDMI video and produces the composite HDMI signal used for broadcasting. Note that we still must record that composite video for our archival webpage.

**Exhibit 8 Video Capture and Recorder.** This device came from the gaming industry. Apparently, when kids play games over the web, they like to record the interaction. So this device accepts an HDMI signal (audio and video) and allows it to be recorded onto a memory stick (flash drive). Notice that a newer model of the Teradek Vidiu incorporates the recording function, thereby eliminating the need for this device.



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**Exhibit 9. HDMI Video Splitter.** This simple device accepts a single HDMI signal as input and generates 4 HDMI signals as output. This can be useful for sending the HD video/audio to church monitors, a recording device, a desktop monitor and the encoder.



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