Live Streaming Basics for Parishes

Where Do You Start?

- It all starts with what the parish wants to accomplish
- The Vestry needs to define what the goals are:
  - Recorded service for posting to web – no in-person worship
  - Live broadcast using Zoom – all remote no usage of sanctuary, recorded and posted to web
  - Live Broadcast to Zoom, FaceBook, YouTube – Small contingent at church, but not parishioners
  - Live Broadcast to Zoom, FaceBook, YouTube - parishioners in the building with some form of communion
  - Live Broadcast to Zoom, FaceBook, YouTube - no restrictions on numbers in the sanctuary, but still want to reach parishioners who cannot attend or out of town (future long term scenario)
- The Vestry needs to decide how much to spend on the project
- The Vestry needs to determine how quickly the system needs to be in place
- A group of tech savvy parishioners need to develop an architecture that meets the cost constraints
  - Hardware based solution
  - Software based solution
  - Availability of items to be purchased
  - Purchase vs. free

Items To Be Aware Of

- Wireless may not be your friend
  - Too many people on a wireless system can cause delays and interference
  - Some fire departments and hospitals can "leak" into your wireless system
- A separate internet connection with static IP could be beneficial
- Costs can be from less than $1000 to over $15,000 or more
- There are multiple solutions to choose from depending upon budget and schedule
- Where are you broadcasting to? Zoom, Facebook, YouTube, other…
- Audio quality is more important than video quality
- Where is the equipment going to reside?
- Lighting where videoing/recording will take place
- You need to establish volunteer production teams
- Music Licensing – there are separate licenses for streaming, label appropriately

Music and Live Streaming

- Music
    - Ensure you have the appropriate licenses in place
    - Streaming Licenses are separate from normal licenses to reproduce lyrics, etc.
    - Label, label, label
        - When posting your recording with music included, be sure to state what license you are using
            - CCLI
            - One License
            - Etc.
        - If Broadcasting Live and you do not have a music license for livestreaming, put a place holder in stating you are playing copyrighted music and will return shortly

Music and Live Streaming (cont.)

- Choirs trying to sing live using Zoom is a non-starter due to how Zoom works
  - Latency issues
  - Multiple voices at the same time confuses Zoom
  - Zoom is working on this
- Best to record choirs and replay for the service
  - This can be time consuming as parts need to be done one at a time and combined in a post production setting using apps such as Acapella (Apple product)
  - Music recordings and be embedded in a PowerPoint Presentation for the worship service

Production Team Volunteers

- Decide on the number of volunteers you will need to run a live stream
  - Number of volunteers depends up:
    - your system
    - where you are broadcasting to
    - the number of services you wish to cover
    - on what the service will be
- Try to encourage youth to take part
- Volunteers should have the ability to understand technical things
- Need to train volunteers for what could go wrong
- Document, Document, Document
  - Procedures need to written and put near the equipment it pertains to
  - Scripts for services need to be developed with directions for camera, audio, etc.

What are the Basic System Requirements

- Every system has the same basic components
  - Camera or cameras
  - Audio source – microphone or microphones, audio mixing board
  - Encoding Device – hardware or software
  - Internet connection

- As with anything else, the more complex the system the more stuff you need
  - Cables
  - Switches
  - Hubs
  - Converters, etc.

Cameras

- This is probably the key design consideration. Here's some basic points:

  - **Smartphones, Laptop cameras and Web Cams** in general don't offer telephoto focal lengths (no zoom, just wide angle). These cameras have a very wide field of view requiring them to be very close to the image source. Having a Zoom lens is essential if shooting from any distance. Long focal length (zoomed in) offers more pleasing image. Zoom is necessary to record from the back of a sanctuary.

  - **Prosumer Cameras** start at around $1,100 and go up. Key feature is sensor size. They provide better low light performance and image quality. Nice but not necessary. Can offer both SDI & HDMI connectivity.

  - **Canon/Sony/Panasonic Consumer Camcorders:** A popular consumer camera is the Canon VIXIA HF R800**:** Great affordable solution. We are using 3 "refurbished" units ($160 from Canon USA – love 'em). Decent HD quality image. Has necessary connectivity and features suitable for live streaming. HDMI only. Clean HDMI out (no overlays). Also records to SD Cards as a backup. Can inject audio from mixer via camera's audio input.

  - **PTZ Optics:** Great solution for remotely operated camera. SDI and also connects via Local Area Network. Pricing starts at about $1000 and go up depending upon connectivity (SDI, NDI, etc.)

Video Sources

- Main elements:
  - Number and price of cameras.
  - Method of transmitting video signal within sanctuary (SDI, HDMI, Cat5e/6 single cable with converters, VLAN direct or with converters).
  - Spatial arrangement of cameras, Alter and space to operate system

- Cable Lengths:
  - HDMI/USB – 15 feet
  - SDI – 300 feet
  - Cat 5e/6 – 360 feet

Audio Sources

- Audio Quality is more important than video quality
- If your church has a sound system with a mixing board, etc. you may be all set
  - Need to get output of mixer to the live stream
  - USB is the usual way to connect
  - If you have an older mixer, may require an audio interface to connect
- Key element is to place a microphone close to each sound source:
  - Pulpit
  - Lectern
  - Piano
  - Room
  - Vocalist

Audio Sources (cont.)

- Close proximity of mic to source avoids echo or reverberation which can make the spoken word hard to understand. Thus, the Lectern & Pulpit mics are most important. Your Rector should probably wear a wireless mic as she/he is moving around while speaking.

- Multiple mics will need to go through a mixer to produce a single (or stereo) audio channel that is then added to the video signal. Your existing system may be all that is needed and might be connected to your video system.

- Equipment is remarkably affordable

- The bane of audio is "ground loops" which cause hum. The topic is beyond the scope of this outline other than to note that isolation transformers (DI boxes) are a good solution.

Hardware Encoding vs Software Encoding

- Encoding is the process of converting a raw video file (codec) into a compatible, compressed and efficient digital format

- Encoding can be accomplished via:
  - Hardware
    - Hardware encoders are dedicated processors that use a designed algorithm to encode video and data into streamable content
  - Software
    - Software encoders are programs that run on your laptop, desktop computer, or another computing device

Hardware Encoding

- Hardware encoders come in both smaller, portable boxes and larger permanent fixtures

- Pros:
  - More reliable than Software
  - Only does one thing – encoding

- Cons:
  - Higher price point - generally
  - Not as flexible in adjusting codecs and other parameters

Software Encoding

- Downloadable software running on a computer

- Pros:
  - Typically easy to set up
  - Customizable codecs
  - Updates are easy to install

- Cons:
  - Lack overall speed
  - Computer Resources are shared – i.e. multiple programs running at same time

Internet Connection

- A stable internet connection is necessary
    - Wireless connection not advised
    - Parishioners in the pews may drag down bandwidth with their phones
- Bandwidth is essential
- If possible, a dedicated internet connection for the live streaming equipment is desired
    - Less interference
    - Wifi can be turned off
    - Dedicated bandwidth
    - Dedicated Local Area Network for equipment of at least 1 GB bandwidth

Live streaming Platforms

- Platforms
  - DIY (Do It Yourself)
    - Zoom – fees based on numbers of participants, can change numbers quickly
    - YouTube
    - FaceBook Live
  - Pay to Play (send your stream to them and they do the rest)
    - Dacast
    - StreamingChurch.TV
    - Vimeo
    - Sunday Streams

Live Steaming Systems

- Live streaming systems can be developed for any budget and time constraint
- Simplest Solutions – Cell Phone Based to FaceBook Live
- Hardware Encoding Based Solutions
- Software Encoding Based Solutions

Simplest Solution

- Cell Phone, microphone, tripod and internet connection
- Suitable for recording or broadcasting to Facebook Live
- Pros:
  - Cheapest solution
  - Short schedule to get up and running
  - Minimal manpower to run
- Cons:
  - Limited capability
  - Wireless connection
  - Quality may be lacking
  - Not all Cell phones have Zoom lens capability – newer smart phones may have

Simplest Solution (cont.)

- It is possible to use multiple cell phones to get more camera angles

- Case Study: St. James, Skaneateles:
    - Mulitple iPhones on tripods
    - Apple software called Switcher – monthly fee
    - Using existing sound equipment
    - For more info: michael@stjamesskan.org
    - https://www.switcherstudio.com/solutions/worship

Hardware Encoding Based Solution

- Case Study: Christ's Church Manlius
  - ATEM Mini
    - A combined hardware and software solution.
    - Provides 4 auto scaling HDMI audio/video inputs and 12 audio channels in a $300 (ATEM Mini) or $600 (ATEM Mini Pro) device. This eliminates the need to buy up to 4 adaptors which makes it an affordable alternative to purchasing HDMI to USB adaptors.
    - Output is recognized as a web cam by your computer,
    - It is an affordable way to deploy an HDMI based multi-camera solution.

Hardware Encoding Based Solution (cont.)

- Provides a simple way to switch between 4 HDMI signals and 12 audio signals including transitions, program/preview switching and fixed media images.

- Connecting to a computer accesses powerful additional features (Upstream and Downstream Keyers – Chroma, Luma and Linear; Picture in Picture and more).

- Can be operated over the internet allowing multiple operators to simultaneously control the unit from different locations. This allows a team approach for more sophisticated productions.

Hardware Encoding Based Solution (cont.)

- The ATEM Mini Pro ($600) adds 3 additional features:
    1) Will stream directly to the internet – one button streaming to YouTube Studio and other streaming services.
    2) Will record program directly to a thumb drive with one button control.
    3) Provides Multiview Display Output which puts all cameras, preview, program and much more information into a single display signal which greatly simplifies the process of monitoring your cameras, audio and all other livestream activity.

- This unit can operate on its own without a computer, sending a live edited program directly to your livestreaming service (YouTube, etc.).

- Its Product Manual is a great resource: https://www.blackmagicdesign.com/products/atemmini

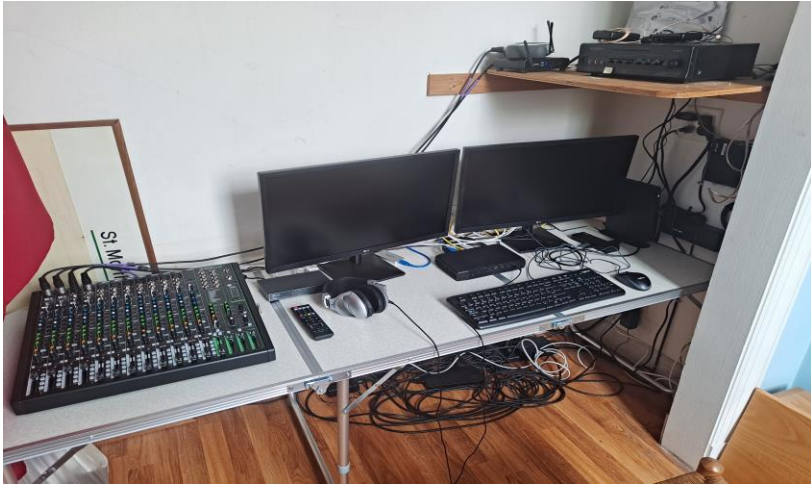# Hardware Encoding Based Solution (cont.)

Software Encoder Based Solution

- Case Study: St. Matthew's Church Liverpool, NY
- Goal: To reach parishioners via Zoom while holding in person worship in the sanctuary long term
- Budget: $5000 (not including recurring costs)
- Schedule: 6 weeks from inception to working
- Challenges:
  - Audio system shortfalls
  - Short schedule
  - Availability of items to be purchased

Software Based Solution (cont.)

- Software used: Opensource Broadcasting Software (OBS)
  - Cost – Free
  - Constantly being updated for new features

- Closed Captioning Solution:
  - Web Captioner – Free, but asks for a donation
  - Easy to use and 95%+ accurate
  - Web based real time captioning

St. Matthew's Live Streaming Setup

Monitor is in the sanctuary and at an angle to the congregation so the congregation and celebrant can see it unless behind the altar.
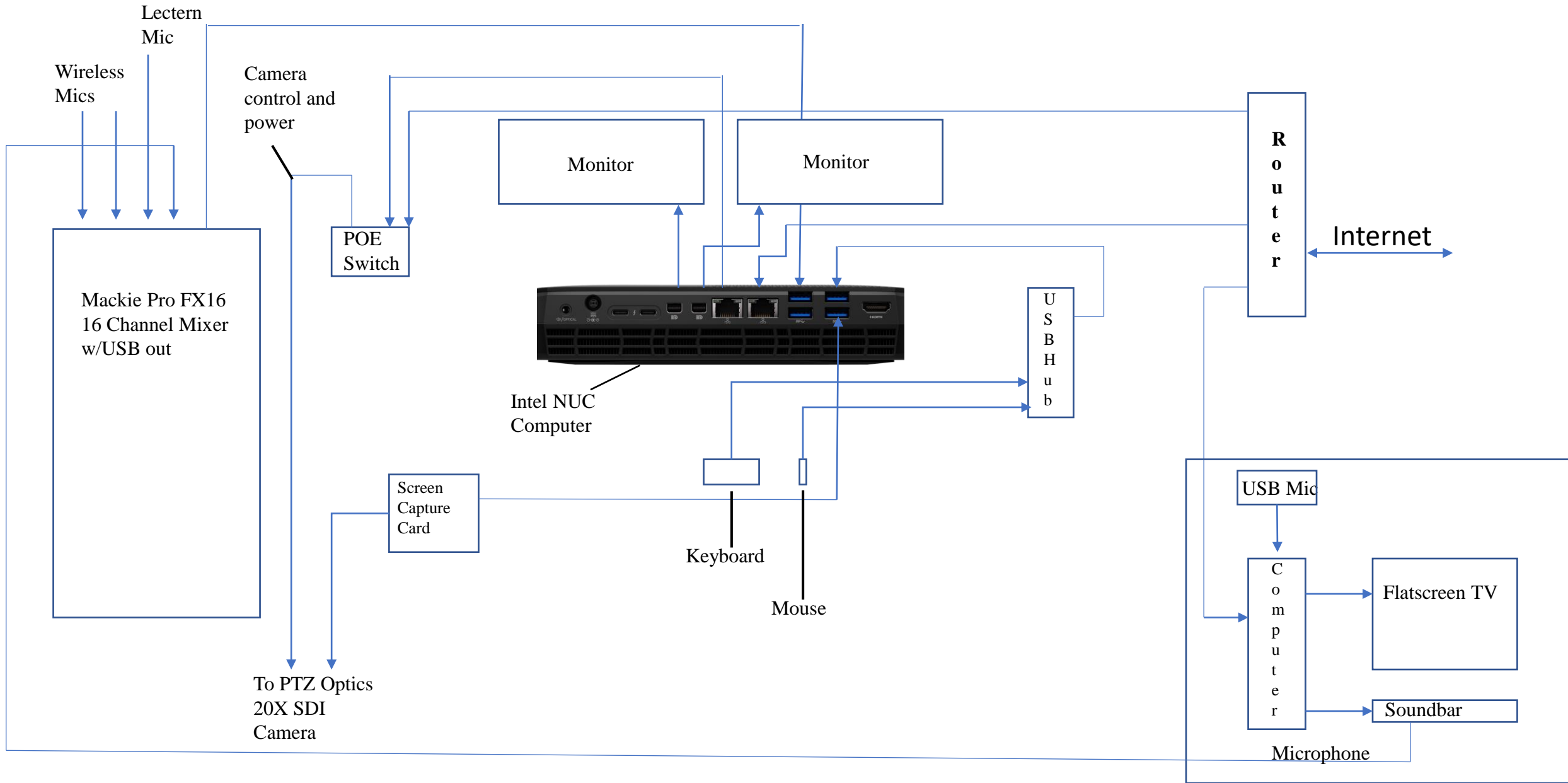

This is in a closet in the vesting room at St. Matthew's.
Space was a limiting factor. All cabling outside the closet is in walls or under the floor.

Pan, tilt, zoom camera mounted on back wall of the sanctuary.

Interconnection Diagram

Lectern Mic

Wireless Mics

Camera control and power

Monitor

Monitor

Router

Internet

POE Switch

Mackie Pro FX16 16 Channel Mixer w/USB out

Intel NUC Computer

USB Hub

Screen Capture Card

Keyboard

Mouse

To PTZ Optics 20X SDI Camera

USB Mic

Computer

Flatscreen TV

Soundbar

Microphone

Equipment and Costs

Recurring Costs	Cost
Internet Only Connection	$91.00/month
CCLI Streaming Music License	~$100/year
One Time Purchase	
PTZ Optics Camera 20X-SDI	$1,699.00
Magewell SDI to USB Capture card	$299.00
Camera control software - free	
TP-Link 8 Port Poe Gigabit Switch | 4 Port Poe 55W | 802.3AF Compliant | Shielded Ports | Traffic Optimization | Plug and Play | Sturdy Metal (TL-SG1008P),Black	$59.99
Plugable USB 3.0 7 port hub	$33.95
Opensource Broadcast Software (OBS) free	
100 ' 3G-SDI cable	$65.00
camera wall mount	$90.00
6' Mini DisplayPort to HDMI Type-A Adapter Cable	$15.98
Hosa HDMA-406 High Speed HDMI Cable with Ethernet, HDMI to HDMI, 6 ft	$9.95
Mackie 16 channel analog mixer	$499.99
Intel NUC NUC8I7HNK Mini PC, Intel Quad-Core i7-8705G	$1,246.00
2 ea. HP - 24f 23.8" IPS LED FHD FreeSync Monitor - Natural Silver	$229.96
Keyboard and mouse (wired)	$15.44
Cat5E Crimping tool, tester and connectors for DSL, LAN, Modem, Networking	$17.99
Cat5e cable - 300'	$26.99
NXT Technologies™ 12-Outlet 2 USB Surge Protector, 8' Braided Cord, 3900 Joules (NX54319)	$49.99
2 HDMI cables for monitors	$11.18
Wireless Headset Mic System	$399.00
24 x 72 table	$39.98
Audio cables	$134.94
USB Microphone	$39.99
Total:	$4,984.32

Resources

- Stream Geeks YouTube Channel

- PTZ Optics: https://ptzoptics.com/
  - Free downloads and how to vidoes

- UDEMY: https://www.udemy.com/
  - Free and minimal cost on-line training courses

- Helping Your Church Live Stream by Paul Richards
  - Available digitally as well

- Mixing for God: A Volunteers Guide to Church Sound by Barry R. Hill

Resources (cont.)

- **YouTube Content Providers (Talking Heads):** YouTube is a great source of knowledge. Providers are earning money putting up great free content (we are the product ;-). Manuals and support for individual components (especially PTZ Optics and Black Magic Design) are also great sources.
  - Ballast Media: http://www.ballastmedia.com/
    Aaron Parecki: https://aaronparecki.com/tag/atem-mini
    Alex Pettitt: https://alexpettitt.tv/
- **Open Broadcasting Software (OBS):** https://obsproject.com/
- **Here to Record:** https://heretorecord.com/
- **Cool Free Teleprompter:** https://teleprompt.me/
- **Hymnary.org:** https://hymnary.org/
- **Bitfocus – Companion:** https://bitfocus.io/companion/

Resources (cont.)

- **Black Magic Design – ATEM Mini:** https://www.blackmagicdesign.com/products/atemmini

- **Behringer.com (for Audio):** https://www.behringer.com/

  - XR18 Wireless Mixer: https://www.behringer.com/product.html?modelCode=P0BI8

  - C-2 Condenser Mic (Pair): https://www.behringer.com/behringer/product?modelCode=P0263

  - Ultralink MS800: https://www.behringer.com/behringer/product?modelCode=P0BKC

- **Pyle Hum Eliminator:**
  https://www.amazon.com/gp/product/B00BARTW42/ref=ppx_yo_dt_b_asin_title_o01_s00?ie=UTF8&psc=1

- **DSLR XLR Adapter:**
  https://www.bhphotovideo.com/c/product/1332706-REG/kopul_cmx_2_v2_two_channel_passive_camcorder.html

Resources (cont.)

- **Interesting LAN Adaptor:**

  - https://www.amazon.com/Extender-Ethernet-CAT5e-Power-Cable/dp/B079M2BFKD/ref=pd_cart_vw_crc_1_1/147-9325214-1622635?_encoding=UTF8&pd_rd_i=B079M2BFKD&pd_rd_r=e5e63a2e-6537-426a-ab6b-43320f62e612&pd_rd_w=9tsK1&pd_rd_wg=tsJ77&pf_rd_p=01004c92-8f40-4f1a-bee8-08cb36dccac2&pf_rd_r=QHHE05NDG1P2BZ3X6KR3&psc=1&refRID=QHHE05NDG1P2BZ3X6KR3

- **Venders:**

  - Canon USA (Refurb): https://shop.usa.canon.com/shop/en/catalog/camcorders/refurbished-consumer-camcorders
    VIXIA HF R800 Refurbished: https://shop.usa.canon.com/shop/en/catalog/vixia-hf-r800-black-refurbished

  - Amazon
    B&H Photo
    Sweetwater
    Thomann USA – Bundle your order to save on overseas shipping. Avoid if product uses using wall wart power supply (220V)