

Streaming Our “Hybrid Services”

Streaming our “HYBRID Services” with a
PTZOptics NDI 30x Camera and OBS
John Roberts

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Background of Trinity United Church

Trinity United Church is located in North Bay, Ontario which is about a 4 hour drive north of Toronto, Ontario. That's in Canada.

Our building was built between 1905 and 1907 so it's not very "technology friendly." We've upgraded the building over the years - we now have running water and indoor washrooms, and we even have some electrical outlets, a few of which are grounded. Seriously though – wi-fi doesn't work well, and running cables through brick, stone and timber-frame is not easy.

Our membership in 2019 was 361 Resident and 123 Non-Resident. Our normal Sunday attendance was around 140 to 160. A lot of our congregation live at cottages all summer and/or go south in the winter.

Trinity is very involved in the Arts with lots of plays, concerts, and cantatas. We have a senior choir (over 30 members), a junior choir, a handbell choir, host 2 concert bands, and a "rock band."

Because of our involvement in the Arts we had several systems in place that helped when we started live streaming. These were our sound system, lighting system and surveillance camera system.

LINK: "Trinity United Church North Bay" <https://trinitynorthbay.ca/>



NOTE: I've provided a lot of links throughout this documentation. As you'll see, it was the volume and quality of the online support content that attracted us to PTZOptics and OBS, so I'll link to some of that content rather than try to redo it myself.

NOTE: The main purpose of this documentation is to show you how we use OBS, which is in the ["How Trinity uses OBS for its Hybrid Services"](#) sections. I've included other topics before and after that to give you the big picture of who we are, our overall approach to our Hybrid Services, and details on the hardware and software we're using.

Equipment in Place Prior to COVID-19

There are several pieces of equipment that Trinity had in place prior to COVID-19 and the start of our live streaming. These are the Audio-Heath QU-24 Mixer and the LP608 Lighting Controller.

Allen & Heath QU-24 Mixer



We already had a modern sound system with a digital mixer board which has 24 input and 30 output channels. The mixer board is at the back of the Sanctuary, but there are also input/output panels at the front. We also have a smaller mixer downstairs in our Fellowship Hall. I think there are 10 speakers in the Sanctuary, and 2 downstairs.

We have ample microphones, including wireless headsets and lavalier mics, and both wireless and wired stand mics.

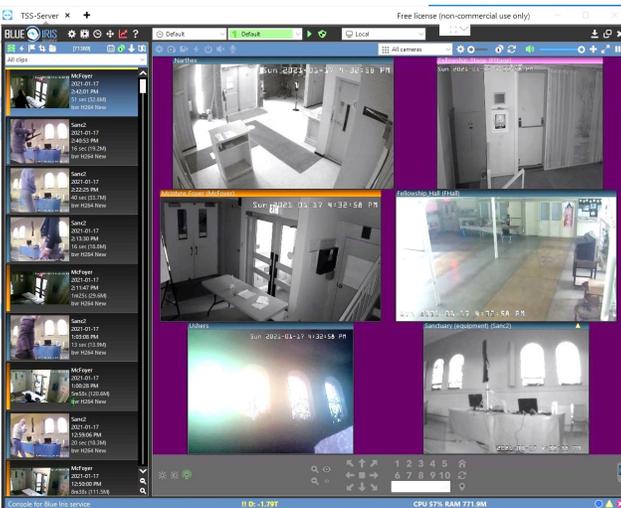
And we have a great sound technician, a volunteer. I don't understand most of what he does, but the sound system has a lot of functionality and he knows how to use it.

LP608 Lighting Controller

We have 2 banks of 4 600w stage lights up in the balcony, controlled by an LP608 controller. This was put in for plays, but the lights enhance the colour on our cameras so we've been using them for our Hybrid Services.



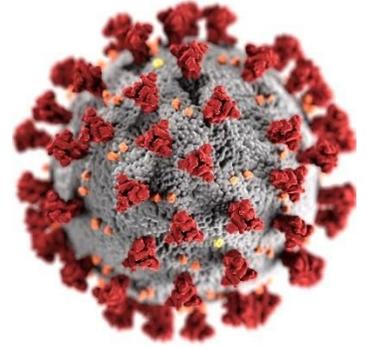
Security Camera System



We installed a security camera system several years ago. There are actually more cameras than shown in this picture but we are partway through rebuilding our LAN to completely isolate the security system from our main LAN which we use for streaming. These cameras are Internet Protocol (IP) and Power Over Ethernet (POE) which taught us how simple but effective these LAN-based protocols can be. And we installed a camera in the Sanctuary which used to record some special events and stream a few services directly to one house-bound congregant. This seemed to overcome any resistance we had to installing cameras in the Sanctuary.

Four Stages of our Service Evolution

Prior to COVID-19 Trinity we didn't have any online services, just the in-person worship we now call "Pre-COVID Services." Starting in March, 2019, with a forced closure, we started posting "Video Services" to YouTube. But right away we started planning for a partial reopening, designing what we called "Hybrid Services." And we're already working on our "Post-COVID Services." I'll define what we mean by each of these terms.



1. Pre-COVID Services

These are the "normal" in-Sanctuary services, prior to March, 2020. I've covered a bit of this in the history above but, other than a couple of experiments, we didn't have any online services, nor did we have plans to create any.

2. Video Services

These are the first online services that we started to post to YouTube in March, 2020 and ran through the summer. These are videos we build off-line. Each participant records their segment at their home, then we assemble them into a single video. We also burn a few DVDs for members who don't have the Internet, and for nursing homes. Our 1st online service on March 22 was a Video Service

3. Hybrid Services

This documentation covers our approach to these "Hybrid Services." These are a mix of live and pre-recorded material. We stream them to YouTube live on Sunday mornings, and also burn a few DVDs. We started our Hybrid Services once our church reopened and we were allowed a small congregation. We also ran a few with only 10 people in the Sanctuary – the max allowable by the Ontario government – but we decided to go back to Video Services until we're allowed to have even a small congregation again. You'll learn how we produce these in a lot of detail as you go through this documentation.

4. Post-COVID Services

We aren't there yet, but I'll share our goals and objectives for "back to normal." Well, back to our "new norm," whatever that is going to be.

Timeline of Trinity's "Video Services" and "Hybrid Services"

- Mar 14 - The TUC Board voted to close our church due to COVID-19 concerns
- Mar 15 - We didn't have a Sunday service – the only one we've missed
- Mar 16 - Ontario recommends closure of all churches
- Mar 16 - A United Church Regional webinar on using Zoom to build services got us started
- Mar 22 - We posted our first "**Video Service**"
 - It was built from Zoom and cell phone recording, and posted to YouTube
- Mar 29 - This was our 1st virtual choir appearance (6 members)
- Apr 12 - We produced 4 services Easter week
 - Our virtual choir was up to 12 members but audio-only to simplify the process
- May 5 - There were several interesting items in our board minutes
 - We struck a committee to start working on "Hybrid Services"
 - We also started on our COVID-19 safety protocols
 - We determined to build a streaming system that we could still use post-COVID
 - The focus would be on sustainability - mostly operating it with 1 or 0 volunteers
 - Our minister noted that he'd miss the visual aids to his sermons
- May 17 - Our virtual choir was over 20 members
- Jun 2 - Our board voted to livestream post-COVID, and discussed scenarios for "Hybrid Services"
- Jun 9 - "PTZOptics Camera Live Training" (Paul Richards) got us started on live streaming
- Jul 28 - Learning continued with "OBS Live Streaming Course" (Paul Richards)
- Sept 13 - We streamed out first "**Hybrid Service**" using a PTZOptics NDI 30x camera and OBS
- Sept 20 - This was our 25th online service
- Oct 11 - We switched from a single large rear-projection screen to two smaller screens
- Nov 8 - This was our 1st use of the "choir pods"
- Nov 15 - This was our 1st use of the "storybook camera"
- Nov 17 - The TUC Board approved the budget for a permanent livestreaming build
- Nov 29 - This was our 100th virtual choir recording
- Dec 21 - Ontario announced province-wide lockdown (Boxing Day to Jan 9)
- Dec 27 - We streamed with only 10 people in the church (no congregation)
- Jan 3 - Again, we streamed with only 10 people in the church
- Jan 10 - This was our 45th online service and our 110th virtual choir recording
- Jan 12 - Ontario announced a Stay-At-Home order, s
- Jan 17 - we switched back to "**Video Services**" rather than have even 10 of us in the Sanctuary

Learnings from our “Video Services”

We average close to 400 views for each of our YouTube services, with 144 channel subscribers. We have had lots of positive feedback from not only our local congregation members, but others across Canada.

Producing our “Video Services” also gave us opportunities to “share” our services with other United Churches in North Bay. We worked with them before they had built up their online service capability, and during our summer shutdown (we take turns closing for a month), and when they had key resources quarantined due to COVID-19. Our minister reached out to them to provide content for the shared services (either live or video) and we would brand the video with the 2 or 3 churches that were involved.

We produced a lot of “Video Services” from March, 2020 through that summer and learned some valuable lessons along the way.

Virtual Choir

Our first virtual choir video was made up of 6 separate videos. Within a few months we had over 20 members of our choir contributing. The virtual choir process was somewhat unknown when we started so we were able to share the processes we developed with several other churches and choirs. This is common knowledge now so I won't get into any detail.

We do though have a reliable and easy process for producing our virtual choir videos, and we've built up a big inventory of hymns we can recycle. This put us in a good position to continue using some Virtual Choir videos as part of our “Hybrid Services” as we move forward. The link below is a short example of one of our virtual choir pieces – it's a musical dedication at the end of one of our recent services. If you watch any of the rest of the service you'll notice that the Christmas decorations are still up. That's because, due to the COVID-19 lockdown, we can't get people into the church to take them down.

LINK: “Trinity United Church, North Bay - Jan 10, 2021 - Epiphany” = <https://youtu.be/bAoY2Qly-FQ?t=2990>

Video Effects to Enhance Services

Our minister is very creative in using video effects during the service. Examples of this are a “picture” or “thought of the day” at the beginning of each service, and various pictures and videos used to help him deliver his message throughout the service. These have worked well and received good feedback so we've incorporated them into our “Hybrid Services” as well. It's a bit trickier to build them into OBS and deliver them on queue than it was to add them with a video editor, but it's proven to be well worth the effort and our young volunteers enjoy the challenge. In this linked example our minister is describing how the process of cleaning an old picture revealed something that hadn't been seen for centuries.

LINK: “Earth Day Sunday, Trinity North Bay” = https://youtu.be/_F1VIBTc4OA?t=1310

Equipment Added to Live Stream our “Hybrid Services”

I’ll briefly touch on each piece of equipment and the software that we are using to deliver our “Hybrid Services.”

The guiding principles in our selection of a camera and streaming software were...

- Keep It Simple
- Affordable
- Sustainable.

Our approach is to explore every option we can find, but then to pick a few key methods and go back through and simplify everything. We might change those few options over time, but we always strive to keep it simple.

Affordable is of course subjective. There are some good services put online with just a cell phone or camcorder, but they are limited. There are also some huge houses of worship with a bunch of cameras and a large tech team, but we can’t afford that. We thought Trinity could afford a system that would give our services the look and feel of the larger productions but with two Point-Tilt-Zoom (PTZ) cameras.

Sustainable is also subjective – but to us it meant having a system that could easily be run by one person, and in a pinch with nobody at the console.

PTZOptics NDI 30x Camera and Open Broadcaster Software” (OBS)

We were attracted to PTZOptics and OBS largely because of the volume and quality of the online support content that was available. I took a uDemy course that finalized the PTZOptics and OBS direction for me.

LINK: “Learn Open Broadcaster Software - OBS Live Streaming Course” =
<https://www.udemy.com/course/obs-live-streaming-course/>

It was clear that this combination met our “KISS” and “sustainable” objectives. The “affordable” criteria was a bit more questionable since the camera was, for Trinity, a big investment. OBS, being free, obviously met the “affordable” criteria.

We were convinced that the PTZOptics camera was perfect for Trinity and the upfront cost would more than repay itself by letting us build a system that we could run with one volunteer. After months of not being able to find a camera in Canada we were finally able to buy one, just in time for us to get ready for our church’s reopening.

The combination of PTZOptics and OBS worked out even better than we expected, and the board has approved the purchase of two cameras.

Did you notice the NDI in the camera name?

Network Device Interface (NDI) is a royalty-free software standard developed by NewTek to enable video-compatible products to communicate, deliver, and receive high-definition video over a computer network in a high-quality, low-latency manner that is frame-accurate and suitable for switching in a live production.

Our experience with the POE IP cameras we used in our surveillance system showed us how easy it is to install and maintain these devices. We only had to run one RJ45 cable to each camera. The NDI standard makes it even easier.



Streaming PC

I'll go through our hardware and software configuration in what I hope will be a logical sequence for a new build.

I'll start with our Streaming PC. This was my personal laptop, but I replaced it when the hard drive failed. I put a new SSD in it and used it for our streaming PC...

- Acer Aspire A517-51 laptop
- Intel Core i3 - 7020U, 2.30 GHz, 3 MB (2 cores, 4 threads)
- First seen on PassMark benchmarks 2018, rating = 2,542
- 8.00 GB RAM
- 120GB SSD
- 2 USB 2.0 Ports, 1 USB 3.0 Ports, 1 USB 3.1 Gen 1 Ports (USB Type-C USB 3.1 Gen 1 (up to 5 Gbps))
- Windows 10

The Acer laptop has performed very well as our streaming PC, but our plans to add more cameras and presentation software like PowerPoint will stress it. So, in February, 2021, we'll be replacing this PC with a more powerful desktop as follows...

Dell G5 Gaming Desktop

- Intel Core i5-10400F processor (6 cores, 12 threads, 12M cache, 2.9GHz to 4.3GHz)
- First seen on benchmarks Q2 2020, PassMark rating = 12,597
- 16GB, 1x16Gb, DDR4, 2666Mhz RAM
- NVIDIA® GeForce® GTX 1650 SUPER™ 4GB GDDR6
- NVIDIA Turing Encoder (NVENC)
- 256GB M.2 PCIe NVMe Solid State Drive + 1TB 7200 rpm 3.5" SATA Hard Drive
- Front Ports - 1 USB 3.1 Gen 1 port, 1 USB 3.1 Gen 1 Type-C® port, 2 USB 2.0 ports, 1 Microphone port, 1 Headphone port
- Back Ports - 2 USB 2.0 ports, 4 Superspeed USB 3.1 Gen 1 ports, 1 Center/subwoofer LFE surround port, 1 Front L/R surround line-out, 1 Audio-in, 1 RJ45 Ethernet port
- Video Card Ports - DP 1.4a, HDMI 2.0b, DL-DVI-D
- NOTE: We upgraded the CPU fan and the case fan to quieter models, and will likely add more RAM
- Windows 10

We currently only use 2 pieces of software when we're streaming. They are OBS and "PTZOptics Camera Control App," You will find more information on both these, and some other behind the scenes drivers, below.

Streaming PC Display Monitors

We use the laptop's monitor for OBS and the camera control app, with a 2nd monitor running in "duplicated" mode. I set this up for mentoring our tech volunteers, and to back them up their first few Sundays. We'll likely still have 2 monitors on the new desktop build, but will use them both for running the streaming software – the laptop screen is perhaps a bit small for the task.

This is probably a good place to introduce our two streaming volunteers. They are 14 and 15 year-olds who have done an amazing job learning not only how to operate the system on a Sunday morning, but also how to program or set it up before then. We have a simple but effective approach to setting up and using OBS which I'll into in more detail further down. One of these teenagers is also heavily involved in the video editing of our "Video Services" but both are very capable and it's been wonderful to have them involved.

OBS Installation and Setup

One of the first things we did was to install OBS on the Streaming PC.

LINK: "How to Install OBS Streaming Software in Windows"
= <https://www.support.com/how-to/how-to-install-obs-streaming-software-in-windows-12830>

Next, we configured OBS to meet our needs. We started with tips from the following video.

LINK: "2019 latest OBS interface overview tutorial video"
= https://www.youtube.com/watch?v=Wh6HUuEkEm4&list=PLBgMaK-_C5BZD5ECCKOBZvwtHy6ir_5cp

We changed the OBS setup over time, based on largely personal preferences and the way we ended up using it. There are more details in following sections.

NDI Installation

Before we could connect our NDI camera to OBS, we installed NDI in OBS. NDI can be used both for input and output. We use the input functionality to connect to our cameras. The output is to feed the OBS output to other computers on the LAN. The link below will let you download NDI, and tell you how to install it.

LINK: "obs-ndi - NewTek NDI™ integration into OBS Studio"
= <https://obsproject.com/forum/resources/obs-ndi-newtek-ndi%E2%84%A2-integration-into-obs-studio.528/>

Second, we set up the NDI camera as a source in OBS. This video will walk you through the process.

LINK: "PTZOptics NDI HX Camera Setup" <https://youtu.be/l4pwwciOYII>

PTZOptics NDI 30x Camera Setup

PTZOptics has a great video that we followed to set the camera up. We use a POE network switch (more on this below) so we only needed a single RJ45 camera to connect the camera. We set the camera at 4=720p60 and did everything else as recommended in this video.

LINK: "PTZOptics NDI HX Camera Setup" <https://youtu.be/l4pwwciOYII>

Camera Controls

We currently have 5 ways of controlling the PTZOptics NDI camera. They are...

1. The control we use the most is the “PTZOptics Camera Control App.” This is a separate app/window on our Windows desktop and sits right beside OBS. It can control 8 cameras, has complete PTZ control, and 9 labeled presets per camera.

You can get this app, and learn how to install and use it, with the following link. Download the manual while you’re there. It has everything you’ll need.

LINK: “PTZOptics Camera Control App” = <https://ptzoptics.com/ptz-app/>



2. Another camera control we have is an X-Box Joystick. Each of us have tried this and, while it works, we’ve stopped using it. This is partly in that It isn’t really useful the way we’ve set up OBS, and is also somewhat limited in the number of buttons it has. We think we’ll use it more in the “Post-COVID Streaming” when we’ll be doing more ad-hoc or unplanned camera movements. It is actually enabled through the “PTZOptics Camera Control App” so use the link above to get more information.

3. We use the “PTZOptics IR Remote Control,” which came free with the camera, a lot. We use this remove to access the camera’s OSD and manage its settings. We also use it to fine-tune our camera presets prior to each service, adjust them for things like the number of “choir pods” (keep reading to see what these are) in use, and the tallness of the lay leaders and position of their lectern.

- Menu
- Exposure
- Colour
- Image
- P/T/Z
- Noise Reduction
- Setup
- Restore Default

LINK: “PTZOptics IR Remote Control - Complete Overview - VLOG #017” = <https://www.youtube.com/watch?v=cZwagVDTAYA>



And check out the shortcuts (combinations of buttons) for things like resetting the camera and managing its IP addresses. Our camera is quite inaccessible where it is mounted, and these shortcuts have saved us from having to get up there on a ladder.

LINK: “PTZOptics IR Remote Control - Using the Shortcuts” = <https://help.ptzoptics.com/support/solutions/articles/13000021835-ptzoptics-ir-remote-control-using-the-shortcuts>

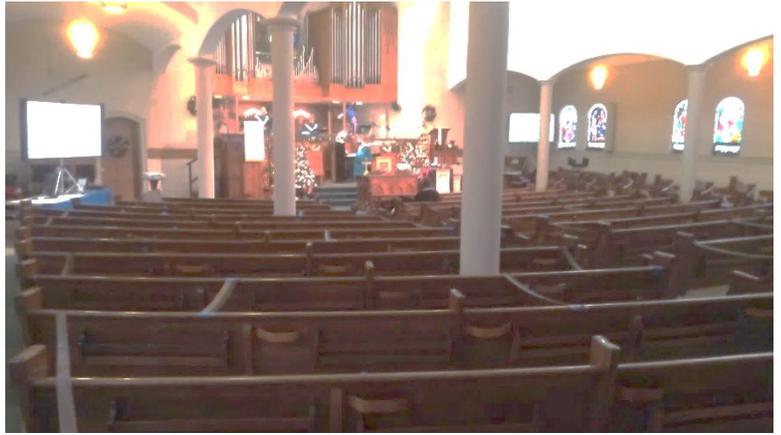
4. We can also setup and control the camera by using Internet Explorer to connect to the camera itself. We use this to set presets higher than the 9 the other controllers offer.
5. And finally, we can call Camera Presets via OBS itself. This cool feature allows us to build the camera control right into the OBS scene. When we’re streaming, this is the primary control that we use. Anything else is to fix something – perhaps the minister has wandered too far. I have more info on this feature in [OBS and the HTTP-CGI Command Sheet from PTZOptics](#) below.

YouTube PC

This is another donated laptop. We run Google Chrome on it and connect it to the YouTube Live! Stream to monitor the stream. YouTube reports on the health of the stream, and we use headphones to monitor the audio. This is an insignificant load and just about any computer could do it. I’ve even used my cell phone to do this monitoring.

Projection in the Sanctuary

We are currently, on a temporary basis, using 2 projector and projector screens. These are located in the front corners of the Sanctuary. To keep things simple during our “Hybrid Services” we simply project what we’re streaming. We’re still working on our “Post-COVID Services” plan but the current thought is to use 85” TVs. The screens are about the same size as a 75” TV so the slightly larger TVs will work well for us. We’ll mount two of them at the front of the Sanctuary and 1 at the back for the worship leaders and choir.



Tech Table

Right now our “tech table” is at the front of the Sanctuary. This is a temporary location because we needed it close to the projectors and a webcam we use. We will be moving it to the rear of the Sanctuary so we’ll be “extending” both the HDMI and USB connections via Cat6 cabling. We hope.



This is one of our teenage volunteers, ready to run the system on a Sunday morning. He’s at the “Streaming PC.” The “YouTube PC” is to his right, and the 2nd monitor at the far end of the table. You can see one of the projector screens sitting on the table.

Behringer U-PHORIA UM2 Audio USB Interface

We use this interface to connect the Allen & Heath QU-24 sound system to the Streaming PC. It handles the audio in both directions. We feed the audio from the microphones into OBS through this interface. The audio output from the video segments of our services is fed to the sound system through this device, using OBS’s “monitor” function. The Behringer Interface has several volume controls on it, but we just set them once and taped them over. There was also a driver that had to be installed in Windows.



We installed the ASIO driver to make the connection between OBS and the Allen & Heath QU-24, but we’re not 100% sure we need it with this interface. We think we do, but we’ll confirm that when we build out the new desktop.

LINK: “Allen & Heath Qu Windows ASIOTM/WDM Driver” = <https://www.allen-heath.com/key-series/qu-series/#tab5>

TP-Link TL-SG1008P 8-Port Gigabit PoE Switch

We built a small, dedicated network in the Sanctuary. It currently has just the following connections...

1. Streaming PC
 - a. We have 2 connections from the Streaming PC to the switch
 - b. We also have a wi-fi connection directly from the Streaming PC to the church’s main router
 - c. We had a couple of streaming glitches with YouTube, and added the other connections to hopefully fix this
 - d. We don’t actually know how the Streaming PC might use these 3 connections, but our YouTube streaming has been excellent since we made these changes
2. PTZOptics NDI 30x camera

3. Link to the church's main LAN, and then to the Internet

This switch can be optimized for NDI traffic, which we'll look into as we add more cameras.

How Trinity uses OBS for its "Hybrid Services"

Finally, let's get into how we've been using OBS.

There are lots of ways to use OBS. I'll go through the approach that has worked well for our Hybrid Services. Our approach is simple and easy to understand and was a logical progression from our Video Services so everyone was familiar with its basic structure.

OBS – One Scene for each segment of Worship Script

Our minister shares his "worship script" with the tech team. We then build an OBS scene for each segment of his service. Sometimes we have several scenes for a segment, but more on that later. Here's a sample worship script ...

January 17th 2021 Worship Script

0. 10:00 – Live Streaming off – setup and testing– camera & sound ON
1. 10:15 – start Live Streaming – "Live streaming will start at 10:20am" – camera & sound OFF
2. ~10:20 – prelude – live - Pre-Music: 2 choir pods
3. 10:29 - Display copyright notice
4. 10:29½ - Today's Image – William Blake: "Eternity is in love with the productions of time."
5. 10:30am - Welcome (Minister in pulpit)
6. hymn 1 - CALL TO WORSHIP (Kids Song): "LIKE A ROCK" – video
7. Prayer of Confession: (Minister near table)
8. Family Story: "Martin's Big Words" by Doreen Rappaport and Bryan Collier (Minister P-I-P)
9. An Extra Video: Free Film for Martin Luther King Jr. Day (saltproject.org) – video
10. Introduction to Scripture: (Minister at table)
11. Scripture: 1 Corinthians 6:12-20 – video
12. hymn 2 - VU 60 Come all Ye Faithful (vs.1,2,3,5) – video
13. Sermon: "In the Flesh" – 3 pictures
14. hymn 3 - VU 31 "O Lord How Shall I Meet You" – video
15. Offertory Prayer and Prayers of the People (Minister at table)
16. lords prayer - VU 959 – video
17. Brief Hymn Introduction: (Minister at table)
18. hymn 4 – VU 266 "AMAZING GRACE" – video
19. Gratitude and Blessing (display the "Dial for Hope" Number?) (Minister at table)
20. benediction – VU 422 "God Be with You" – video
22. postlude – live

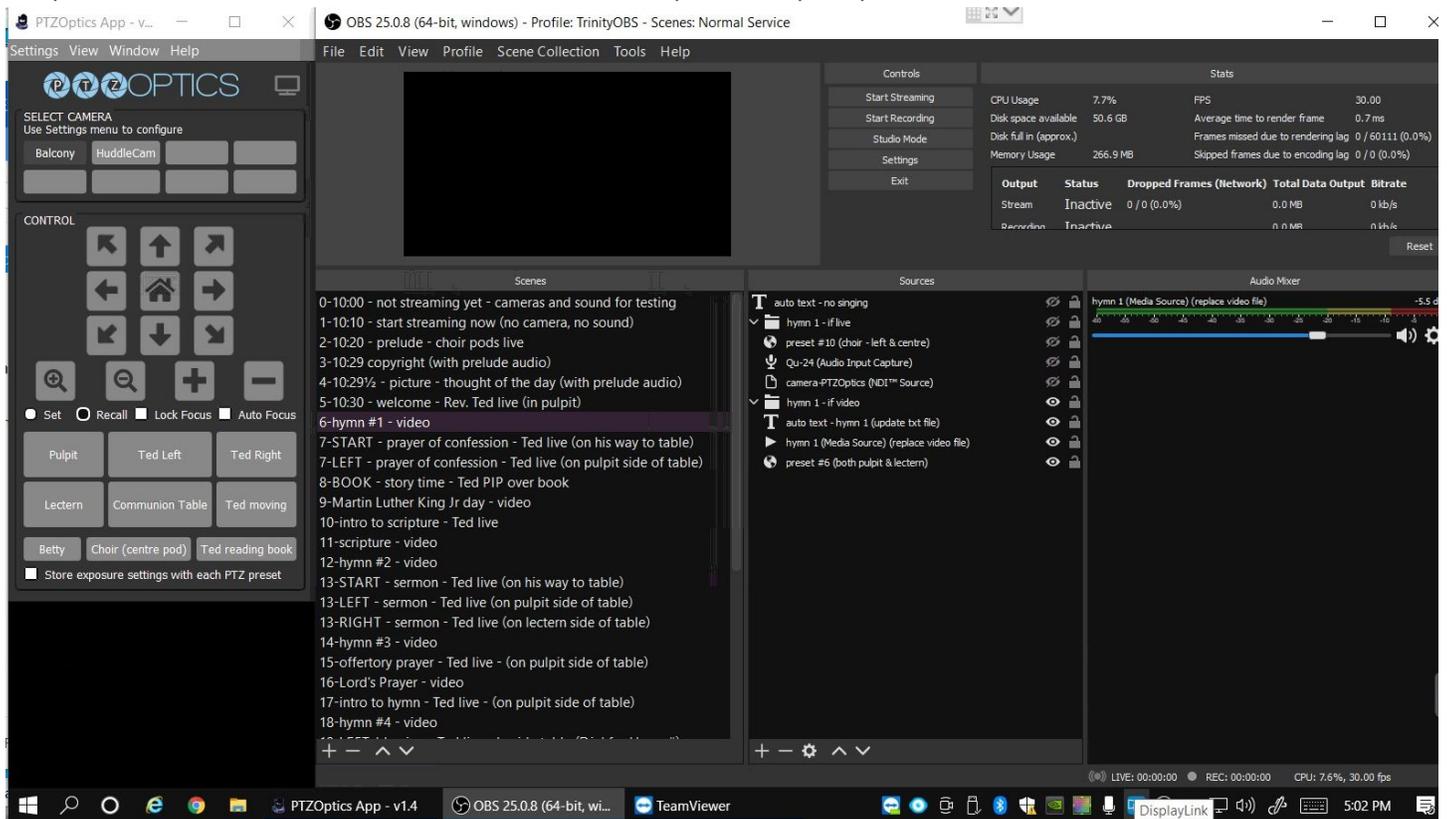
The tech team then builds all the segments in the worship script into OBS, with each segment being a scene. We don't recreate this each week, but just modify the previous week's setup as needed for the next week.

The kind of things we have to change week-to-week are...

- The order of the segments, although they don't change all that much.
- If a segment is "live" or a "video." One of the key points of our "Hybrid Services" is that any given segment can be delivered live in the Sanctuary, or via video. An example of this is the scripture reading above – this would normally have been delivered live but with the COVID-19 situation this week's reader was more comfortable doing it via video.
- For the live segments we have to know what to do with the camera, so who is it and where will they be?
- And we look for any "special effects" we have to build into OBS. Examples from this week are the 3 pictures our minister wanted displayed during his sermon, and the "Dial for Hope" phone number to be displayed during the Gratitude and Blessing segment.

On Sunday mornings all we have to do is start the streaming, then click through the OBS scenes in sequence. We get the full script prior to the service, and that allows us to be better prepared for upcoming scene changes. We also work with the minister to determine how he'll be cueing the special effects.

The picture below shows the scenes we built for the sample worship script shown above.



OBS – what our Desktop looks like

The picture above also shows what our desktop looks like. Remember we're using a laptop so the layout is mostly derived from having to work with a small screen. I'm sure it will change when we switch to the desktop and dual "extended" monitors.

The "PTZOptics Control App" is on the left. Each live scene has a camera preset built into it so we only have to use this app for fixing things "on the fly." Examples of this are the minister or lay leader not being exactly where we were expecting them to be, or there being 3 vocalists instead of 2.

We don't use OBS's "studio mode." This would give us a "preview" and a "program" window, and lots of neat transitions. It doesn't though match the way we build our scenes – it can't preview the next camera preset since we only have 1 camera and it can't move until we switch to that scene. And it doesn't show a preview of a video, perhaps since we typically start our videos with a fade-in. We also don't need a preview since we've built everything into the scene itself. I expect we'll switch to "studio mode" for our "Post-COVID Services" when the scene structure will be entirely different.

OBS – testing

Once we've built all the scenes, we run a quick test. We start "recording" and run each scene long enough to get into some audio, using a microphone for the live scenes. Then we stop recording and play the video to make sure every scene functions as we expect it to. As we get better at all this there is likely less need to run this test, but we're still doing it.

Storybook Cam

This has been a huge success for us. Trinity is blessed with a lot of families with children in its congregation. Pre-COVID the children would be in the Sanctuary with us through segments like the opening prayers and announcements. Then they'd gather at the front of the Sanctuary where our minister would read them a story, then they'd go off to Sunday School. Everybody enjoyed these stories, but only the children at the front could see the book. In our Hybrid Services we started using what we call a "storybook cam" for these segments. It's just a webcam on an arm, with the PTZOptics shot of our minister as a picture-in-picture.

We of course needed this so people at home could see the book, but with the projector screens the people in the congregation can now see the book as well. We plan on keeping this for our Post-COVID Services. You can see the storybook cam in action at the link below. Check it out. Hopefully it'll work as well for you as it has for us.

LINK: "Trinity Worship Service for Jan 17, 2021" = <https://youtu.be/bHLnzVrueD4?t=323>



Choir Pods



Our virtual choir has worked well for us, and is still going strong, but we missed live music. Two of our choir members built these 3 "Choir Pods." They are 3-sided plexiglass enclosures, with a mic in each, designed with input from our local Health Unit. They are each big enough to accommodate 2 vocalists if they are from the same household.

Our Sanctuary has a lot of windows and lights, and of course the stage lights are on while we're live streaming. We were worried about reflection so the pods were built in a manner that the front panel could be tilted. We didn't have to adjust anything though – the camera

placement worked out perfectly with no reflection at all. We do get a bit of reflection in the far right corner, just below the flutist, but that reflection is actually the plexiglass music holder on the organ, which tilts back a bit.

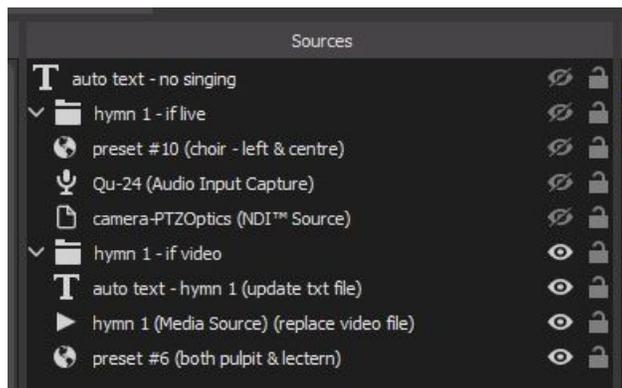
If you watch the link below you'll see the 3 choir pods in action. For this service we the flutist in a more temporary enclosure at the back of the choir loft, with a mic and a web cam in there with her.

The choir pods have enriched our Hybrid Services, and given us the flexibility of each piece of music either being a video or live.

LINK: "Trinity United Church - Christmas Eve Service -Dec 24, 2020" = <https://youtu.be/JGxVY0bNJYY?t=97>

OBS – scenes with sources for “live” and “video” segments

With some scenes in our Hybrid Services, like hymns and scripture, being live one week and a video the following week we built scenes to enable this flexibility. Rather than rebuild the scene every time it changed, we have both live and video sources built into the scene, and simply “hide” the one we don’t need. In the example to the right, hymn 1, you’ll see that the video sources are visible, and the live sources hidden.



OBS – Visibility Timer

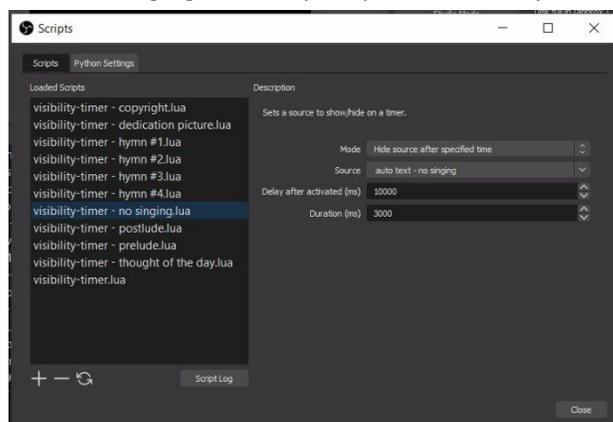
The first source in that same picture is an example of text that is automatically displayed then hidden again. In this case it reminds people in the congregation that they aren’t allowed to sing while they are in the Sanctuary. This is a COVID-19 restriction, but we noticed that some congregants had trouble remembering. Our COVID-19 safety protocol committee asked us to display this reminder with every hymn. The streaming tech could do this manually, but we’ve found the automatic process works better. Notice we named this source “auto text – no singing” so everybody knows exactly what it is. It’s actually hidden in the picture because we didn’t have a congregation when we live streamed this service.

The “OBS Visibility Timer” we use for this is a Lua script. We can set how long we want the source displayed, and when it should start. The link below has information on downloading and using this script.

LINK: “OBS Lua Visibility Timer”

= <https://obsproject.com/forum/resources/visibility-timer.638/>

This is what it looks like for this “auto text – no singing” source. This is set to display this text 10 seconds into the scene, for a duration of 3 seconds.



OBS and the HTTP-CGI Command Sheet from PTZOptics

I mentioned this above as 1 of our 5 camera controls, but I’ll give you some detail here. This feature allows you to code a command and build it into your OBS scene via the web browser input. You can download the HTTP-CGI Command Sheet at the link below.

LINK: “PTZOptics HTTP-CGI Control Sheet”

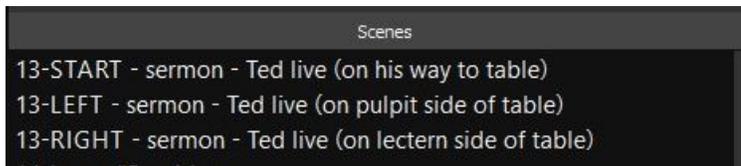
= https://ptzoptics.com/wp-content/uploads/2021/01/PTZOptics-HTTP-CGI-Commands-Rev-1_5-1-21.pdf

In the picture at the top of this page you can see 2 examples of this in use. They are the web browser sources that we’ve named “preset #10 (choir – left & centre)” and “preset #6 (both pulpit & lectern).”

The specific http command used for this is “http://192.168.1.251/cgi-bin/ptzctrl.cgi?ptzcmd&poscall&10” where “192.168.1.251” is the IP address of the camera we want to control, and the “10” at the end is the preset we want to call. To use it just add a “Browser” source, put the http command in the URL field, and be sure to check the “Refresh browser when scene becomes active” option. Using preset #10 for the live shot makes sense – it’s one of several presets we have for the choir pods. But using preset #6 for a video segment isn’t as intuitive. We do this to move the camera where it’s needed for the next live shot. We only have 1 camera so if we don’t move it ahead of time then the camera motion shows in our live stream. Note that we can only move it in advance like this when we have a video scene right before the live scene.

This is one of the main reasons we want a second camera. The second camera will allow us to move the camera we aren’t using to the preset for the next scene, and eliminate having to watch it pan. The second camera will also provide a backup.

OBS – extra scenes for PTZOptics camera presets

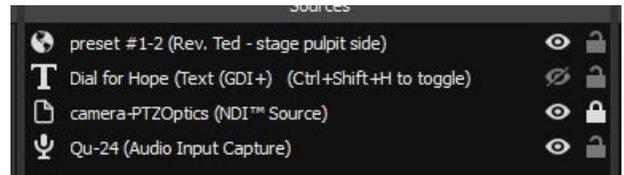


Our minister moves around during his segments. Several of the 5 camera controls we mentioned above would allow the streaming tech to follow him, but we've found it easier to create several scenes that we use to move the camera. These are virtually identical

scenes, with the only difference being the camera preset that's called in each scene. The "START" scene has a wide camera setting that'll allow him to move from the pulpit down to the stage. The "LEFT" and "RIGHT" scenes each cover ½ the stage, and allow the tech operator to follow the minister as he moves back and forth.

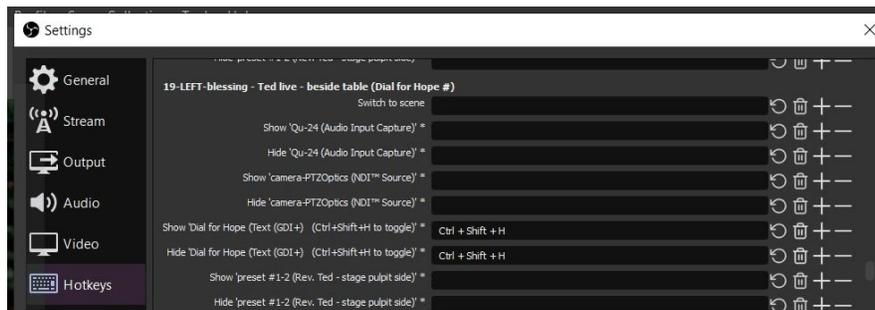
OBS – Hotkeys

We use OBS hotkeys to toggle special effects on and then off again. In the picture to the right, you'll see that the "Dial for Hope" source can be toggled with a [Ctrl]+[Shift]+H key combination. Again, this is well labelled so the streaming tech knows what to do.

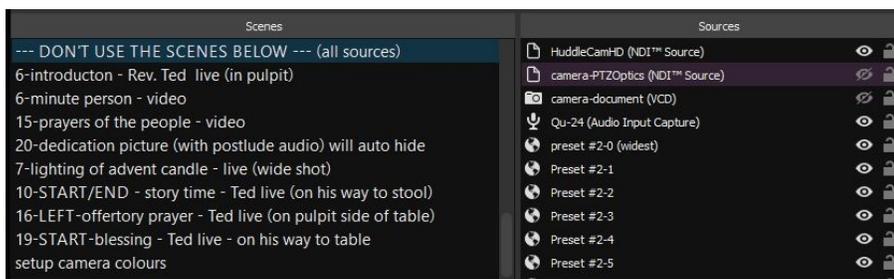


LINK: "How to use Hotkeys in OBS" = <https://streamgeeks.us/how-to-use-hotkeys-in-obs/>

Hotkeys can do a lot more than this simple task that we use the for. The link above has all the information on all their capabilities. The picture below shows how you set this up in the OBS Settings/Hotkeys section.



OBS – Scene with all Sources



I want to show you 2 things in this picture. First – the highlighted scene with all our sources in it. I add a new source here, basically to make sure I only have to add it once. Then, if I end up deleting it from the last scene that uses it, or delete that last scene, I'll still have that source. That makes it easy to add in again later by selecting "add existing source."

The other thing we do to save duplicate work is move scenes we aren't currently using below that "DON'T USE THE SCENES BELOW" scene. Our streaming techs know that the scenes below there aren't for use for the service they're streaming. But those same scenes can simply be moved up when they are needed again.

OBS – standardized filenames

I didn't really know what to call this tip. It might even be hard to explain, but here goes. I'll use that same example of the sources for hymn 1. When I used this same picture above it was to show how we have sources for both live and video content for the scenes that switch back and forth week-to-week in our Hybrid Services. This tip is basically an extension of that idea.

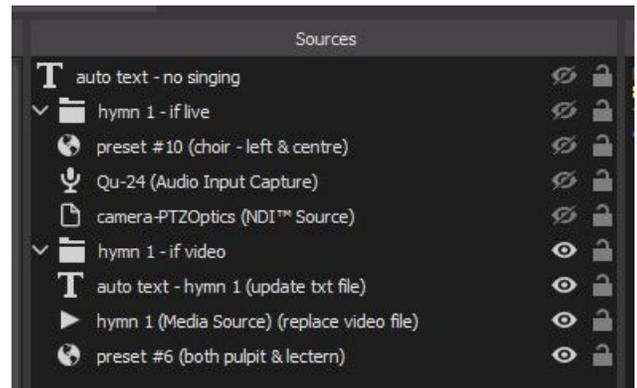
You'll see the "hymn 1 (Media Source)" source. It plays a video file name "hymn 1.mp4." By using that name we just have to swap that file with next week's first hymn – so there's nothing to change in the OBS setup.

By using these standardized filenames, we just replace the files and we're all set. We also use this for a lot of text files, which display things like credits for live music, and the date of the service. Those files have self-explanatory names like "prelude.txt," "postlude.txt," "hymn 1.mp4," and "date.txt."

We've taken this a step further by using various utilities to get these files in place. I update the files in a directory on my hard drive, which is then synced to my Google Drive, which is then synced to the Streaming PC's hard drive. So I simply update or replace the file in that folder on my hard drive, and within a few minutes the Streaming PC has the file and is all set.

TeamViewer

Several of our computers at Trinity are set up so that we can access them from home. The Streaming PC is the latest one we added to the list. We can do all the OBS setup from home, and even run the test, but we have to be in the Sanctuary in person to stream the service. We can't do things like set up new cameras, adjust presets from home. We go in during the week for the former, and do things like the presets just before the service on Sunday. There are a bunch of apps that provide this functionality but we're using TeamViewer.



Post-COVID Services

We're in the planning stage of our Post-COVID Services. We don't know when we'll get there, or exactly what it'll look like, but we're planning for something a lot more like our Pre-COVID Services than either our Video Services or our Hybrid Services. That means it'll be almost entirely live, with only an occasional video and a few video effects. The biggest difference from our Pre-COVID Services is that we'll be streaming our Post-COVID Services.

There are some things we'll carry forward from our Hybrid Services. These include the storybook cam and the use of special effects to enhance our services. These will require what we're calling in-Sanctuary projection, although we're planning to use TVs rather than projectors and screens.

Our tech table has to move to the back of the Sanctuary, beside the sound system and the lighting control. That requires us to figure out how to run USB and HDMI over 30 meters, likely by using Cat6 cables and convertors.

Post-COVID - More Cameras

We have a second PTZOptics NDI 30x camera in the approved budget so we'll be purchasing that. We expect to mount it on the balcony beside the other camera. The main reason we want the 2nd camera is to let us change presets without having to watch the camera's PTZ movement. It will also be a backup camera. We have a problem with vibration caused by people moving around on the balcony which we'll have to overcome.

We have also just acquired a HuddleCamHD NDI EPTZ webcam, which we only used for one Hybrid Service to-date. It doesn't have a motorized PTZ, but its 4k resolution let's us move our 720p target zone around in the larger frame almost like it was a PTZ camera. It has to be a lot closer to the subject than our PTZOptics camera. We'll likely keep this camera on a tripod and move it around the Sanctuary as required. Being NDI it is easy to plug into the LAN anywhere so we'll put a few extra RJ45 jacks around the Sanctuary to facilitate moving this camera.

We hope to be able to continue to use the USB camera for our storybook cam. If though we can't overcome the distance issue we can use the HuddleCamHD for our storybook cam.

Post-COVID - Scenes will be completely different

In our Hybrid Services are scenes follow our minister's worship script. In the Post-COVID Services they'll be based on camera shots. So we'll have scenes like pulpit, lectern, and choir.

We hope to have a streaming tech run OBS for every service, switching cameras and scenes as necessary. We expect to use OBS's "studio mode" to let us get the next camera/preset ready for a quick change.

Post-COVID - Video Effects

We want to enable our minister to continue to use pictures and videos to enhance his services. I have no doubt we can do this, but don't yet know how we'll do it other than I think it'll be a mix of OBS and PowerPoint functionality.

Post-COVID – OBS Integration with Sound System and Lighting Control

Our goal for our Post-COVID Streaming is to be able to do all the tech work with just one operator – our “streaming tech.”

In our Pre-COVID Services we only had 2 mics. The minister uses a headset mic that he mutes when he’s not using it, and we have a mic on the lectern that can be left on all the time. But in order to stream our Post-COVID services we’ll need mics for the piano, organ, and choir. All these will have to be muted when they are not being used. We don’t want to have another tech to operate the mixer, nor do we want the streaming tech to have to run the mixer as well, so we’re hoping to be able to operate them from a single central control.

We didn’t use the lighting system at all during our pre-COVID Services. We started using it in our Hybrid Services, but just ran all the lights at mid-brightness. We’d like to have specific setting for things like the pulpit, lectern and choir. Again – we don’t want yet another operator, nor do we want to further burden the streaming tech.

Both the Audio-Heath QU-24 sound system and the LP608 Lighting Control have some remote control functionality and their own version of presets so we’re hoping we can get OBS to control each of them. This might be possible by issuing midi commands to them. If OBS can’t do this for us, we’ll look at yet another piece of “central control” software that can manage OBS, the mixer, and the lighting controller.

Hopefully this diagram will explain what we’re hoping to do...

Logical Scene	OBS	QU-24	LP608
Minister in pulpit	scene = pulpit		
	select camera		
	select preset		
	send midi to QU-24 >>>	only minister's mic on	
	send midi to LP608 >>>		just pulpit lights on
Lay leader at lectern	scene = lectern		
	select camera		
	select preset		
	send midi to QU-24 >>>	only lectern mic on	
	send midi to LP608 >>>		just lectern lights on
Choir	scene = choir		
	select camera		
	select preset		
	send midi to QU-24 >>>	only choir mic(s) on	
	send midi to LP608 >>>		just choir lights on

Figure 2 (OBS Integration with Sound System and Lighting Control)

OBS Documentation Last Updated: Jan 26, 2021

This is the documentation we provide for our streaming techs. We give this documentation to new techs to review first, then we go through it with them in a “hands-on session. Next, they use this documentation to do it all themselves, with a more experienced tech there to answer questions. We’ve found that new techs are able to, and comfortable with, running everything on their own within a few weeks.

Sunday Morning – before the service (turning everything on)

1. Turn on the power bar under the tech table - that will power up the 1st projector and the extra monitor.
2. Up in the Sanctuary, plug in all the extension cords (fire marshal’s regulations require these to be unplugged when we’re not there).
 - a. There’s one for the other projector. It plugs into the outlet beside the stairs on the lectern side.
 - b. There are 2 for the lights. These are hanging from the balcony, one on each side. They plug into the outlets near where the extension cords are hanging. The lights will flash a bit while they warm up and the controller tests everything.
3. Start both the Streaming PC and the YouTube PC. Note though that they might already be running.
4. Turn on the sound system. That’s 5 breakers in the electrical panel down in the kitchen. Note that one of them goes ON first and OFF last.
5. Sign into the Streaming PC (password= ____).
 - a. If TeamViewer is running, stop it.
 - b. If OBS is not running, start it.
 - c. The PTZOptics control panel app should be running. If it’s not, start it. Arrange this window and the OBS window so you can see them both. Click on the [Balcony] to select that camera. You’ll know it’s ready when you can see the names of the presets.
6. Run a quick test of all systems.
 - a. Turn on the hand-held microphone. You’ll use it to test the feed from the sound system to OBS.
 - b. Run a couple of “scenes” - at least one using the camera and the microphone, and at least one of the videos. You’re making sure the camera, microphone, and sound systems feeds (both ways) are working.
 - c. Turn off the hand-held microphone.
7. There are a few adjustments you’ll have to make, or at least check.
 - a. Work with the lay leader to adjust the preset(s) we use for them. With our temporary lectern it might have been relocated, and you’ll want to adjust the preset for this week’s lay leader who might be taller or shorter than last week’s.
 - b. Work with the minister to set up the storybook cam for the size of this week’s book, and the location of the stool. Discuss any cueing he might be doing during the storybook segment.
 - c. If anything on the steps has been moved (e.g. the communion table) work with the minister to adjust the presets used for the sermon.
 - d. Briefly run each video to adjust the volume.
 - e. If the minister has any video effects in the service discuss the timing and cueing with him.
 - f. Check with the minister of music to see when you should start the prelude.
8. On the YouTube PC (password= ____).
 - a. Start Chrome and click on the “Streaming” bookmark. It should say “Connect streaming software...”, have the correct date, and be set for Public.
 - b. Confirm that the “stream key” displayed on the YouTube PC is the same as the one OBS is using (OBS/Options/Streaming). If it’s different - GET HELP!
9. Turn on both projectors.
 - a. Open the lens cover.
 - b. Hold the power button for several seconds to force it to start.
 - c. Hopefully the images are correct! If they’re not there you might have to start them in OBS. Right-click on the preview screen and send the Full-Screen Preview to the Epson.
10. That’s it. Everything is now powered up and ready to go.

Sunday Morning – streaming the service (running OBS)

1. On the Streaming PC, at the time indicated...
 - a. 10:15...
 - Select the 1st scene in OBS. This says “Welcome...Streaming will start at 10:30. This scene is a static picture with no audio.
 - Start the OBS streaming. Note that this will start OBS recording as well. This is a backup since YouTube will record the whole stream.
 - Confirm that OBS is streaming and recording on the right side of the OBS status bar.
 - Confirm that the stream is displaying on the YouTube PC. Note that there is a lag of several minutes.
 - Confirm that the image is being displayed on both projectors.
 - Turn on the lights.
 - ◆ Use the lighting control panel on the table beside the sound system console.
 - ◆ It has to be in “scene” mode rather than “effects.”
 - ◆ Touch the 6th button and they should come on about ½ power.
 - ◆ If they don’t want to work, just unplug the 2 extension cords and run without them. They improve the colour but are not necessary.
 - b. 10:20 (or whenever our minister of music wants to start the prelude)...
 - Click on the prelude scene. .
 - ◆ This will start the camera and select the appropriate preset for the number of choir pods being used.
 - ◆ It will also start the QU-24 feed from the sound system.
 - c. 10:29 - Click on the “copyright” scene. This will overlay some legal text on the camera video.
 - d. 10:29½ - Click on the “quote of the day” scene. You can sit on this scene until the prelude finishes. If it’s finished before you get here just show it for about 15 seconds.
 - e. 10:30 - Click on the lay leader’s welcome scene.
 - f. From now on you just follow the script, clicking on each scene as appropriate. Some scenes have an extra step or two, as follows...
 - Rev. Ted’s blessing: You can make the Dial-for-Hope phone # visible while he is talking about it.
 - Rev. Ted’s sermon - he will work from either the left side or the right side of the stage. You will have to move the camera to its appropriate preset when he moves. There are several ways of doing this.
 - ◆ The presets are #2 for the pulpit side (left from the camera’s view) and #3 for the lectern side (right).
 - ◆ We now have 3 scenes for most of Rev. Ted’s stuff. The “START” scene is a wide shot that takes in the pulpit to the communion table. The “LEFT” and “RIGHT” scenes are the respective sides. So you’d open with “START” and then when he’s made it down to the bottom step switch to “LEFT.”
 - ◆ You can do this with the PTZ control app window by clicking on the preset. You have to click on “balcony” first, and anytime you get an error message. This connects the app to the camera.
 - ◆ You can do this with the joystick by using the 4-button cluster on the right side.
 - ◆ You can do this with the remote by clicking on the preset #. You have to click on camera 1 first, but hopefully only once. The remote is the hardest to use since you’re beyond its range and it has to be point directly at the camera.
 - For any scene with singing we have a text message reminding people in the congregation not to sing. This displays automatically for 3 seconds after a 15 second delay.
 - If there are other scenes with multiple parts or special effects we’ll let you know ahead of time.
2. There are several things you should monitor throughout the service.
 - a. Check that the streaming is working on the YouTube PC.

- b. You can check the audio using the headphones. The streaming has gone from OBS on the large laptop, out over the Internet to YouTube, then back over the Internet to Chrome on the small laptop, so there is a lag. This is what the at-home viewers are seeing and hearing. Note that the sound tech is likely monitoring this as well as they adjust their audio mix for our streaming.
- c. YouTube will indicate the quality of the stream. It is normally Excellent. If it's poorer than that for more than a few seconds - GET HELP!
- d. Keep your eye on the YouTube chat area. People at home might report an issue through the chat.
- e. You can also confirm that OBS is recording (and streaming) by checking both on the right side of the OBS status bar.
- f. Monitor the volumes for everything. They should be preset but...
- g. Check the projected images. You can see the far screen, but can only see some light and colour coming out of the lens of the near screen. We project the same image as we stream, and both projectors get the same signal.

Sunday morning - after the service (turning everything off)

1. On the Streaming PC...
 - a. Stop OBS streaming and recording.
 - b. Close all windows.
 - c. Start TeamViewer.
 - d. Leave the Streaming PC powered on so we can access it from home.
2. On the YouTube PC...
 - a. Close all windows.
 - b. Power off the PC.
3. Turn off the lights...
 - a. Tap the "black" button on the right to turn them off.
 - b. Unplug both the extension cords.
4. Turn off both projectors...
 - a. Close the lens cover.
 - b. You don't have to power them off since you'll be unplugging them.
 - c. Unplug the extension cord on the lectern and turn off the power bar under the tech table.
5. Turn off the sound system, although the "lift operator" might have already done this. If the Christmas lights in the Fellowship Hall are ON then the sound system is ON.

Prior to Sunday Morning - setting up the scenes in OBS

I'll be doing this for the foreseeable future, but am starting on the documentation. I now do a lot of this from home via TeamViewer.

1. This can be done Thursday, Friday, or Saturday. Or even real early Sunday morning if you're brave.
2. Run all the steps in "Sunday Morning - setup (turning everything on)..." above.
3. Delete last week's recordings, which are in the "OBS Recordings" folder. The Streaming PC has a relatively small SSD so we want to make sure there'll be room for the new recordings.
4. Delete last week's service bits - it's a folder on the Desktop. Replace it with this week's service bits - in a new folder. I collect all this at home and bring it in on a flash drive. A lot of the files are now updated automatically so there's less to do here.
5. Update anything that needs updating in YouTube. This includes the date of the service which is in the stream's title and all the copyright stuff in the YouTube description box. The YouTube PC is the best one to use for this.
6. Update all the "scenes" in OBS, according to the minister's "worship script."
 - a. I put a check mark on each segment in the worship script as I finish setting it up in OBS.
7. Test the scene setup in OBS.
 - a. Turn on everything, including the sound system.
 - Actually - you don't need the YouTube PC for this test.
 - b. Start OBS's recording. Don't start streaming for this test.
 - Run every scene long enough to get both video and audio.
 - There are likely about a score of scenes so if you run each for 15 seconds the recorded video will be about 5 minutes long.
 - For any scenes that have "special effects" you might want to test them briefly. For instance make the Dial-for-Hope phone # visible for a second, then hide it again.
 - After you've been through everything...
 - Stop the recording.
 - c. Shut down OBS
 - d. Check what was recorded on the Streaming PC.
 - The test recording will be in the "OBS Recordings" folder.
 - Make sure there is audio in every segment - it's easy to miss the "output" in video playback.
 - Make sure the segments match the worship script.
 - I put a 2nd check on each segment to indicate it's been tested.
 - e. Delete the recordings after you've checked them.
 - f. Run all the steps in "Sunday morning - after the service (turning everything off)" above.