Video Streaming

For Webster Presbyterian Church

“I would like for you techies to come up with a plan to provide a live streaming product to the people when we get to the other side. Start with $xxk for planning” *Coach Keith*

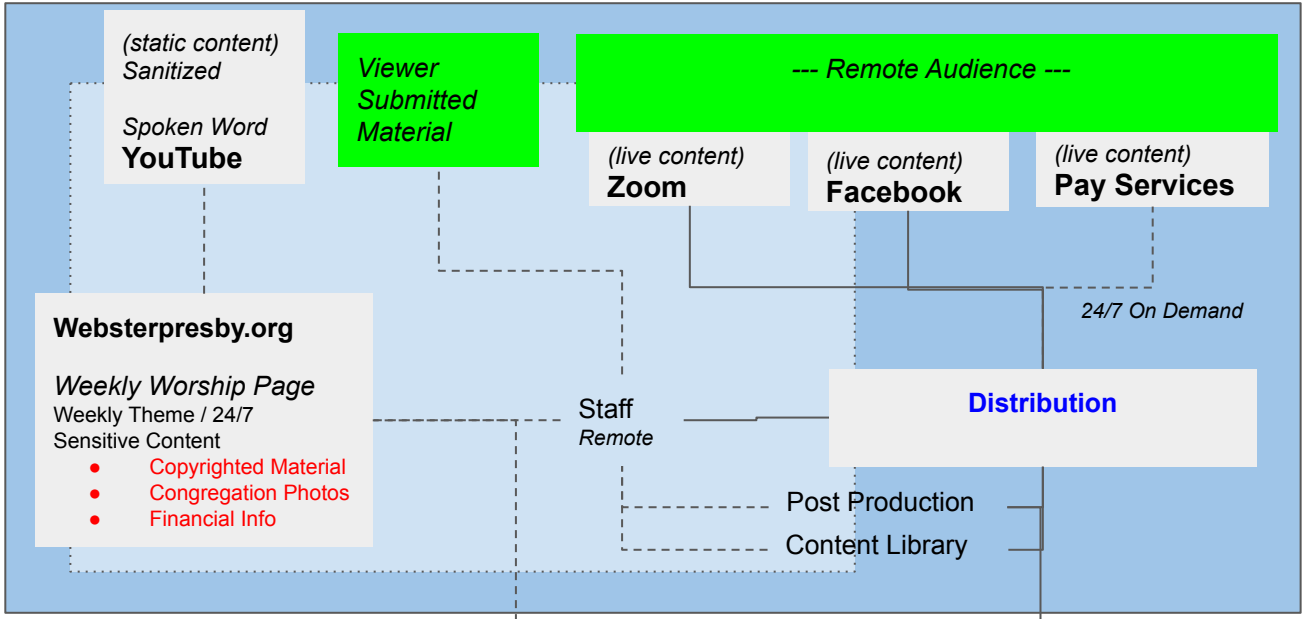
“Go ahead and fold in everything to get the overall story”
Professor Keith

“We need to let Session’s know what we are doing”
Pastor Keith

“I’m getting pressure to open”
Pastor Keith

--- Implementation ---

Early Architect Plan



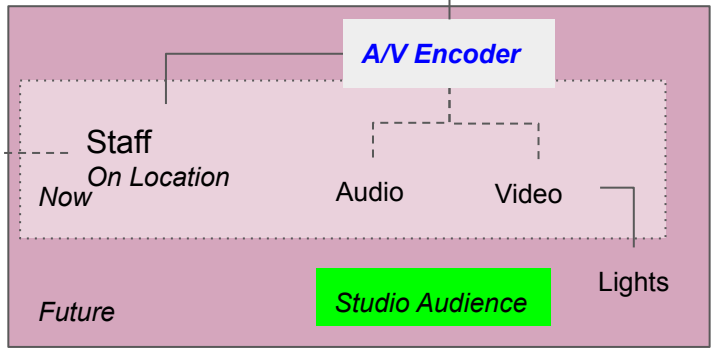
Policies
Legal
Insurance
Governesses

Facilities

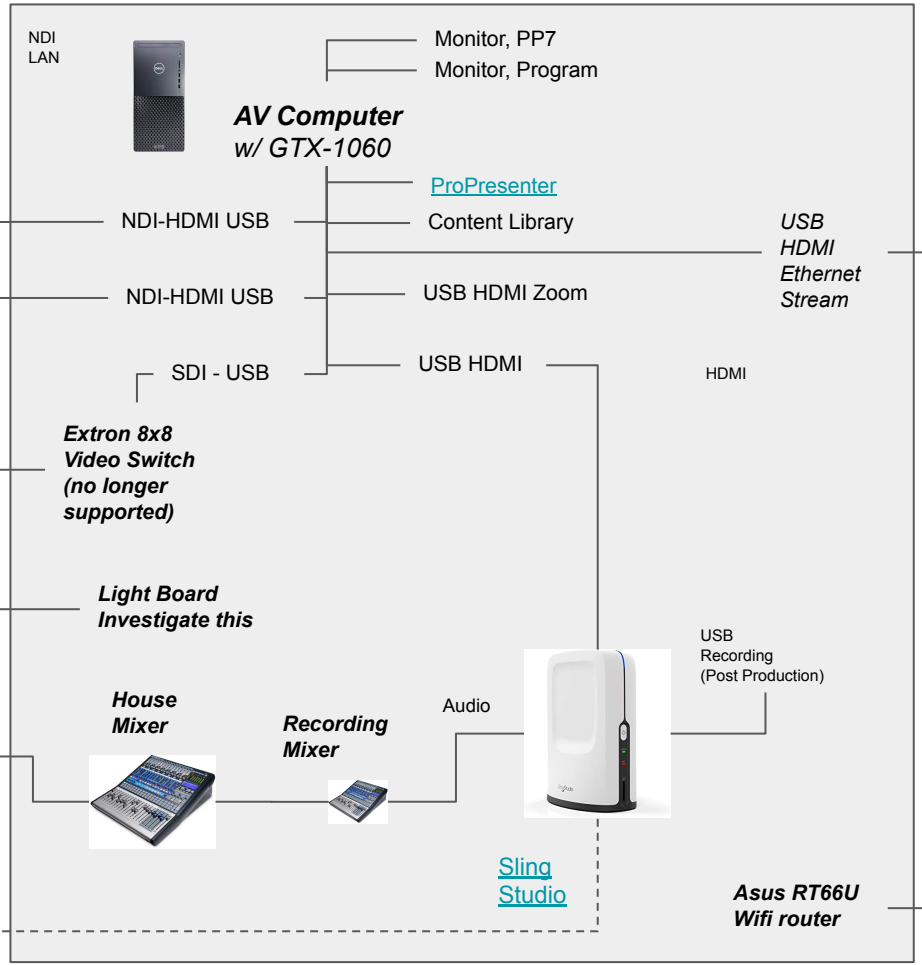
An A/V encoder lets WPC:
- *Record*
- *Create videos*
- *Post on-demand videos*
- *Stream live events*

Distribution allows
- *Extended Reach*
- *Controlled Reach*
- *Convenient Reach*

Watch for self distribution advances



Equipment, As-Built



Distribution & Planning

Switch, Monitored

Office Closet Modem 10/100

Network
(2x Bandwidth)

GOAL

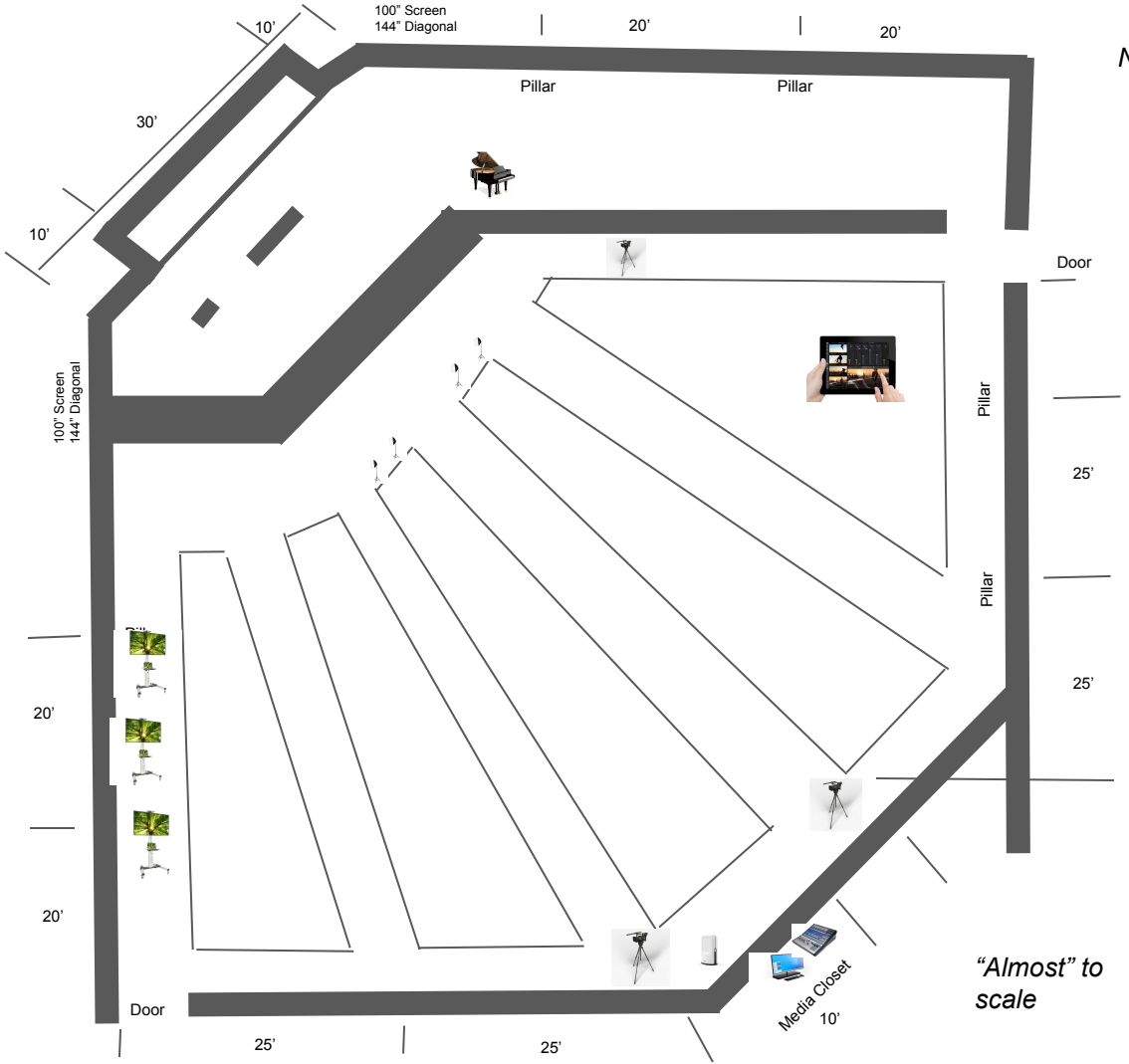
External Distribution

Full Service Solutions

WPC.COM

BoxCast.TV

Equipment, As-Built



Timeline Plan (Details w/ Cost)

Class/Comments	Details	Features
Class (Amateur) Free	~~**Start - 100% manual**~~	
Class (Amateur) free after gear Multicam (4-10 sources)	**Interim (~$4500) - Highly Manual** 1. ~~Personal Cameras~~ 2. ~~Open air mics~~ 3. ~~Add Fluorescents~~ 4. ~~SlingStudio All-In-One (useable / limited)~~ 5. Setup 6. Content Integration Tools ($400) (ASAP) 7. Practice / shakedown (we are here) 8. Go Live - mid June	PostProduction (Manual) Lights (temporary) Audio (field) Distribution (self)
We are here =>		
Class (SemiPro) **Class (Prosumer)**	**Future ($20k-40k *To be Reviewed*) -** 1. House Sound (in work) 2. Enhanced Post Production / Broadcast Distribution 3. Facility Remodel a. LED Lighting (remove & replace old system, accessibility) b. Pro Audio House sound (existing house system vs. smaller desk) c. Multiformat A/V Mixer w/ remote PTZ (watch the technology) d. Projector Repair / LED Wall Monitors 75/85/100 *(Sanctuary, Narthex & Facility)*	PostProduction (Integrated) Lights (House) Audio (House) Distribution (Pay)
Professional($5k-20k/min) i.e. Broadcast, Syndicate TV Premium ($25k-50k/min) i.e. Sporting Event, Syndicate Hollywood ($100k-$1M/min) i.e. Cinema		

Watch Areas

Wrap Up

1. People - Team Adaptability / Sustainability
   a. Migration to ProPresenter
2. People - Audience inclusion / Interaction
   a. Improve in-house experience
   b. Continue to deliver post produced product
   c. Stream (begin with Zoom)
3. Products - Technology Advances (Capability & Pricing changing daily)
4. Products - Quality Content our Audience will watch (live / on-demand)
5. Products - Ability to self distribute content i.e. WPCTV.COM
6. Processes - Facility Vision & Alignment / Message Vision
7. Processes - Quality Standards, Post Production & Scheduling
8. Processes - Distribution

Questions

1. What is this approach missing?
2. Prior pitfalls?
3. Suggestions to improve “engagement”?
4. Coop with other Presbyterians for economies of scale?
5. Posture: DIY vs. Turn Key?

Thank You

Questions?

Details & Backups

Why?

Before Covid-19

- Engagement and Reach
- Community Needs
- Timeliness
- The Intangible
- Keeping in the Habit
- Outreach

Today

- *Livestreaming was legitimate before C-19 and more-so now*
- *Livestreaming supplements existing WPC Web and Social Media presence*

Distribution & Privacy

FB Live — Keith is a no (I do not want myself plastered all over FB — too many negative folks who feel free to critique harshly)

Public Web Page:
https://www.websterpresby.org/ - No posting allowed

WPC You Tube Site - Public / Posting Allowed
https://www.youtube.com/channel/UCkvUNdKoAH0SRtExgJmreCA

WPC Public FB Site - No Posting Allowed
https://www.facebook.com/websterpresby.org

WPC Private FB Site - Posting Allowed
https://www.facebook.com/search/top/?q=wpc%20family%20of%20faith

Direct 2 Way Channel - Ultimate privacy
Goal

Privacy is balanced with participation through ***"Levels of Access"***

"Windows" *were comments are permitted (with ample* ***moderators****) during livestreams / recorded streams*

Benchmark Sites:

A+
https://www.facebook.com/cypressumc/videos/23112011458494

Short Messages
https://www.facebook.com/clpc.org

Youth Centric:
https://www.facebook.com/CLPCNextGen

Plan

Research

Set Priorities

Charted a Roadmap

Research more

Filled out Roadmap

Sanity check

Proposals Budgetary Planning Estimates

Buy-in and implementation

Priorities

Initial

1. Quality Product
2. Ease of access for viewers
3. Reduce volunteer burnout / post production time
4. Inclusive of church contributors (stills, music, content)
5. Useful NOW, useful for the future
6. Synergy with future church plans
7. Leverage existing church assets (sound board, network, media center)

Expanded

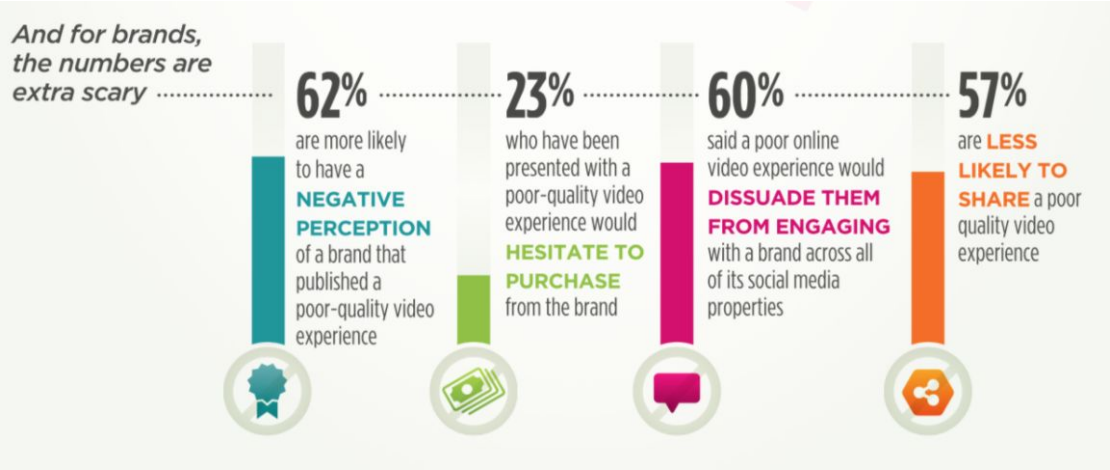
Gather everything to provide the big picture

Listed Priorities intact from start

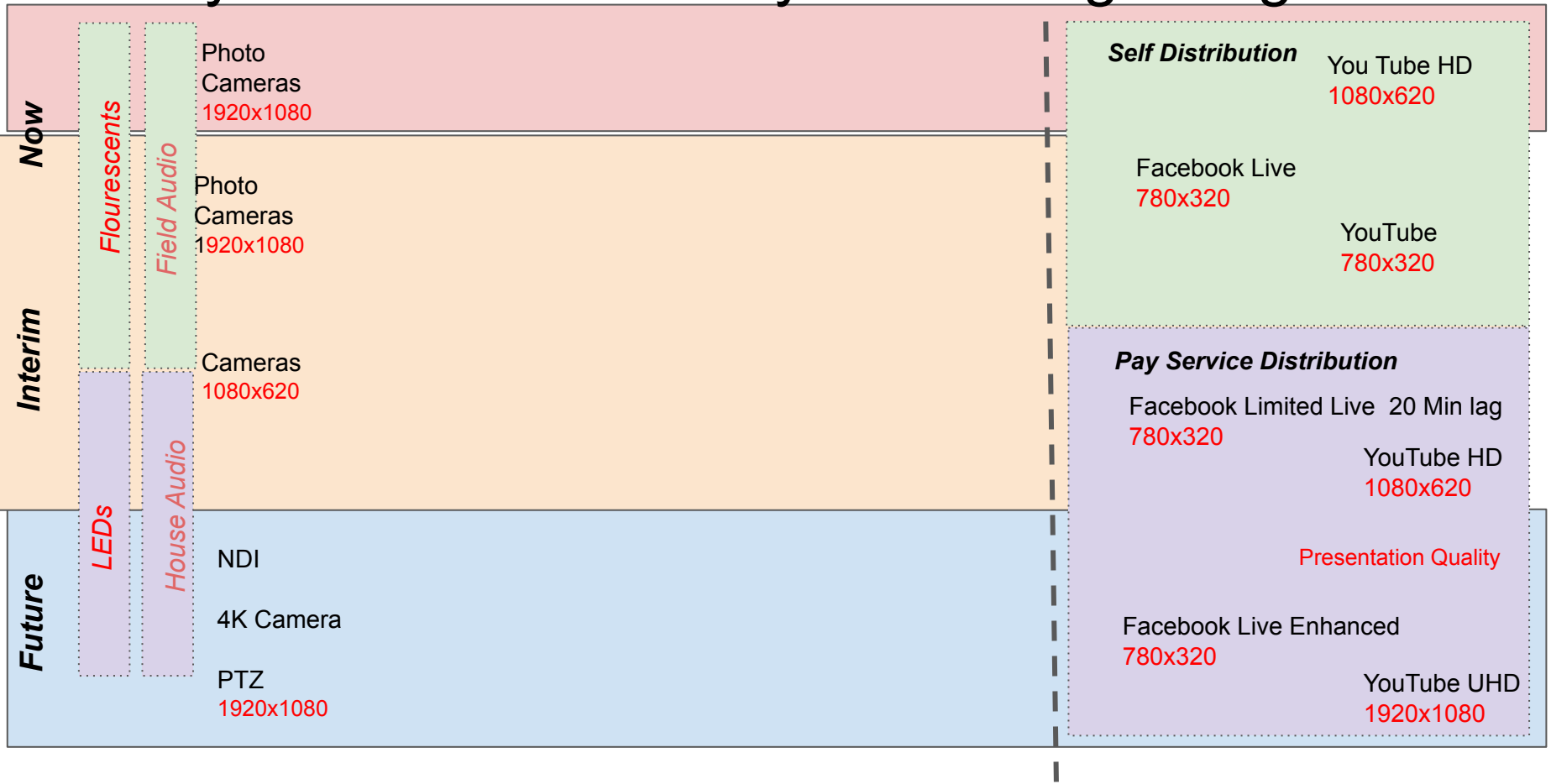
Best Value approach

Early Road Map Plan	**Tools**	**Day 1** *1st 6 weeks* - Borrowed* *(record/edit/stream)*	**Now Interim** - Borrowed* *(record/edit/stream)* *($4,500)*	**Reopen Day 1** - Borrowed/owned (record/edit/stream)"Semi-live stream" C-19 Protocols	**Goal** *(Optimized flow - facility centric)* *(~$40,000)*
Content Capture	**Lights** *most Important*	Dan & Ross's spot lamps	Additional Fluorescents	Distant Hotlights Localized Reinforcement	**House w/ spots & floods** (in-situ) Accessible / Maintainable
	Audio *extremely important*	Ross's 2 Channel Studio Local mixing / House mics*	Added field mixer Audio Recording	New House Soundboard installed w/ Audio Recording	**New House soundboard** integrated to Workbench Room & individual micing
	Cameras *If lights/audio good, cameras can vary*	Canon 7D DSLR Sony HDR-CX675*	Migrate to Wifi Cams Smart Phone & video cam	Three (wide, tight, rover) w/ Tripods & Wifi Walkie Talkies w/ headset	**Three (wide, tight, rover)** Rover Production class w/Tripods Mounted Pan/tilt/zoom - remote 4K?
	Video Switcher Encoder Network	None	Sling Studio (All-In-One) w/ recording	Sling Studio (all-in-one) w/ recording	**Integrated / Networked** (Audio & Cameras, signal and operator) Connects with Post Production / Library / Broadcast Sling Studio (Portable Backup) House Monitors
Production Distribution Broadcast Promotion	**WorkBench / Studio**	Dennis & India Post Production assemble/captioning	Scattered Library Andy - Post shoot cleanup Dennis's - clip edits India's - polish	ProPresenter Integrated Library	
	Distribution *- goal*	Replay (YouTube)	Replay (edited Recordings) WPC Website YouTube	Replay (edited Recordings) WPC Website YouTube	Replay & Limited Livestream Commercial Distribution *(bandwidth?)*
	Operators	Volunteers	Volunteers / Call for helpers		**College Interns** **Staff Production**

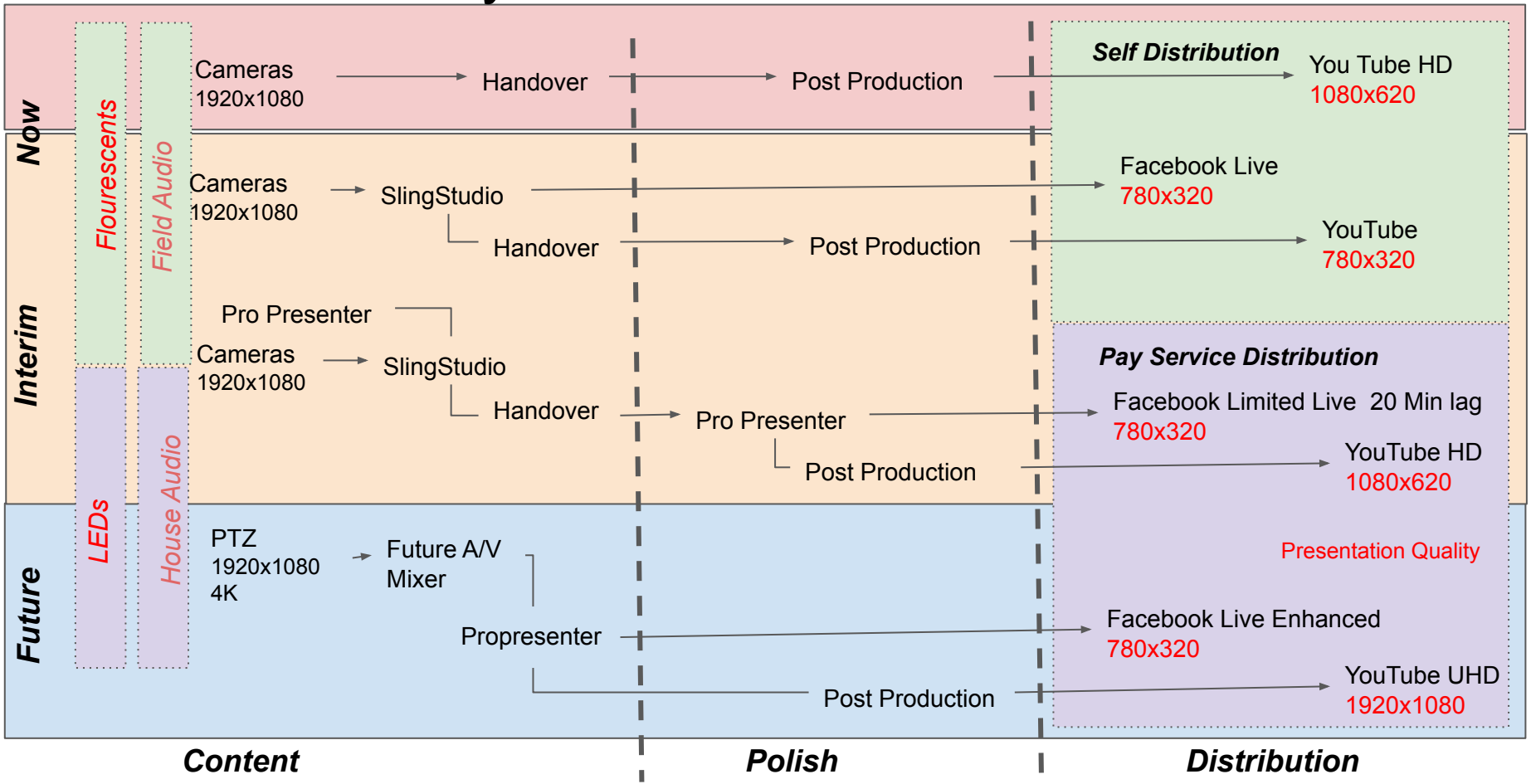
Priority 1 - Quality Product



Maturity Plan - Video Quality will be degrading



Workflow Maturity Plan



Plan for Post Production

[Project Workflow in Final Cut Pro X • Foreword Blog]

Free Tools

Consumer Tools
- $35-75

Prosumer Tools
- Final Cut Pro / Adobe Premiere Pro
- $300-400 (with annual fees)

- **Download footage from shared Google drive and create a folder to hold these and all other service materials (video clips and photos should not be moved once added into the video editing program)**
- **Retrieve all companion materials from Google Drive, ShareFaith, and emails and add to service folder (all materials added to Google Drive folder by contributors would save time)**
- **Compose YouTube Details doc by copying the Order of Worship and removing liturgy, images, and announcements**
- **Copy text citations and list of participants from Order of Worship and compose credits**
- **Retrieve all music citation info from Hymnal website/Glenn email/Order of Worship and add to credits and YT Details as needed**
- **Using Order of Worship to ensure all content is present and in order, add video footage to editing program (currently Premiere Pro)**
- **Trim each “scene” to start and end points and remove gaps between**
- **Correct color in each scene**
- **If time allows, remove or reduce audio anomalies and stutters/stammers**
- **Build and add prelude visuals and add on top of audio**
- **Build and add postlude visuals and credits**
- **Add transitions between scenes**
- **Add title captions to each section according to Order of Worship**
- **Using the Order of Worship, add congregational responses and hymn lyrics (from Hymnal Online or Glenn) to each section as appropriate**
- **Adjust audio in each scene (last on my todo list, I usually don’t have time to do much of this)**
- **Render video**
- **Upload video to YouTube**
- **Adjust settings in YouTube including privacy setting, preview thumbnail, audience, playlists, cards, end screen**
- **Copy and paste prepared YouTube Details document content into the Details description box**
- **While watching playback, enter time stamps next to each heading in the Details screen**
- **Save to launch!**
- **Email YouTube link to SWAT (Saturday Worship Action Team)**

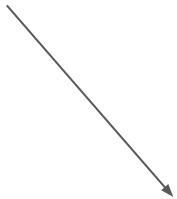
Plan for Lights

Summary:

In place system not workable

Bring in additional fluorescents (interim)

Too many future unknowns



1. Existing Overheads (not usable)
2. Existing Sanctuary (insufficient)
3. Dan's 85W CFL softboxes - 2each (functional)
4. Ross's hot-lights (functional but "hot")
5. Additional 135W CFL softboxes - 3 each (interim)

6. Monitor/Influence Sanctuary redesign
7.
8. $8,500 in plan
9. Goal:
   a. LED
   b. Variable Temperature
   c. Dimmable
   d. DMX desired, not mandatolry
   e. "Set anywhere" (until future sanctuary defined)

Plan for Projectors (on hold)

Summary

In place system broken (~$16k replacement)

Difficult location to maintain

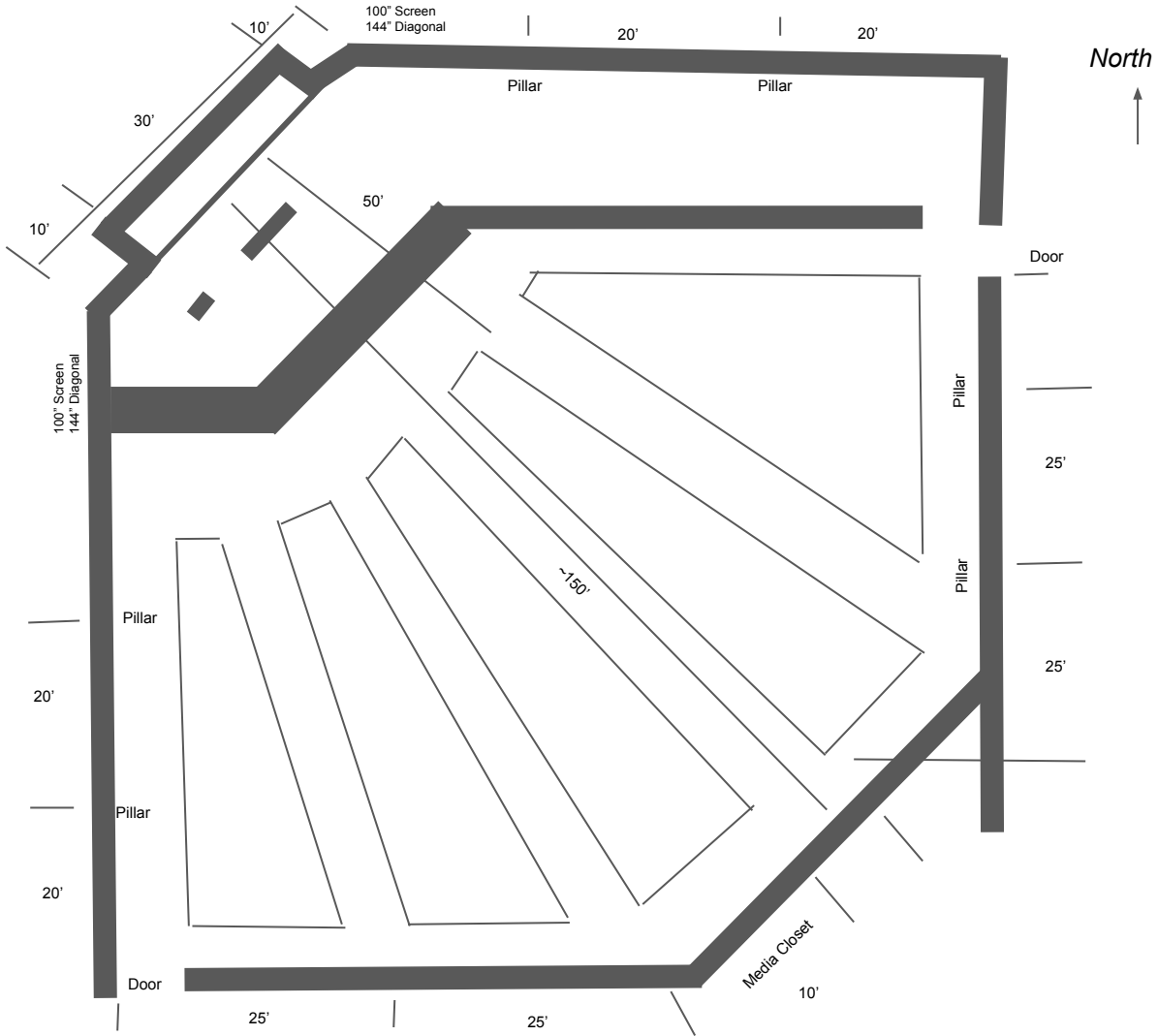
a. Nobody present to watch

Locations for 65” LED Monitors identified (near pillars)

b. Within Sanctuary
c. Narthex & meeting rooms
d. Wifi Connected
e. Today, ~$1k w/ wifi & mounting
f. Integrate and feed using ProPresenter 7

LED Monitors continue to fall in price
Monitor “grouping” w/ ProPresenter

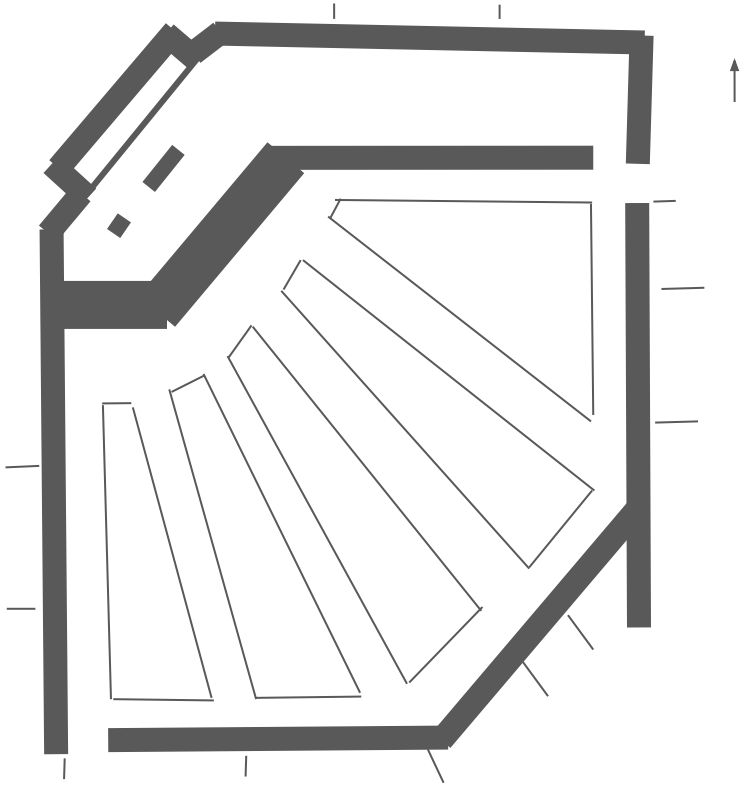
Discovered remodel plans



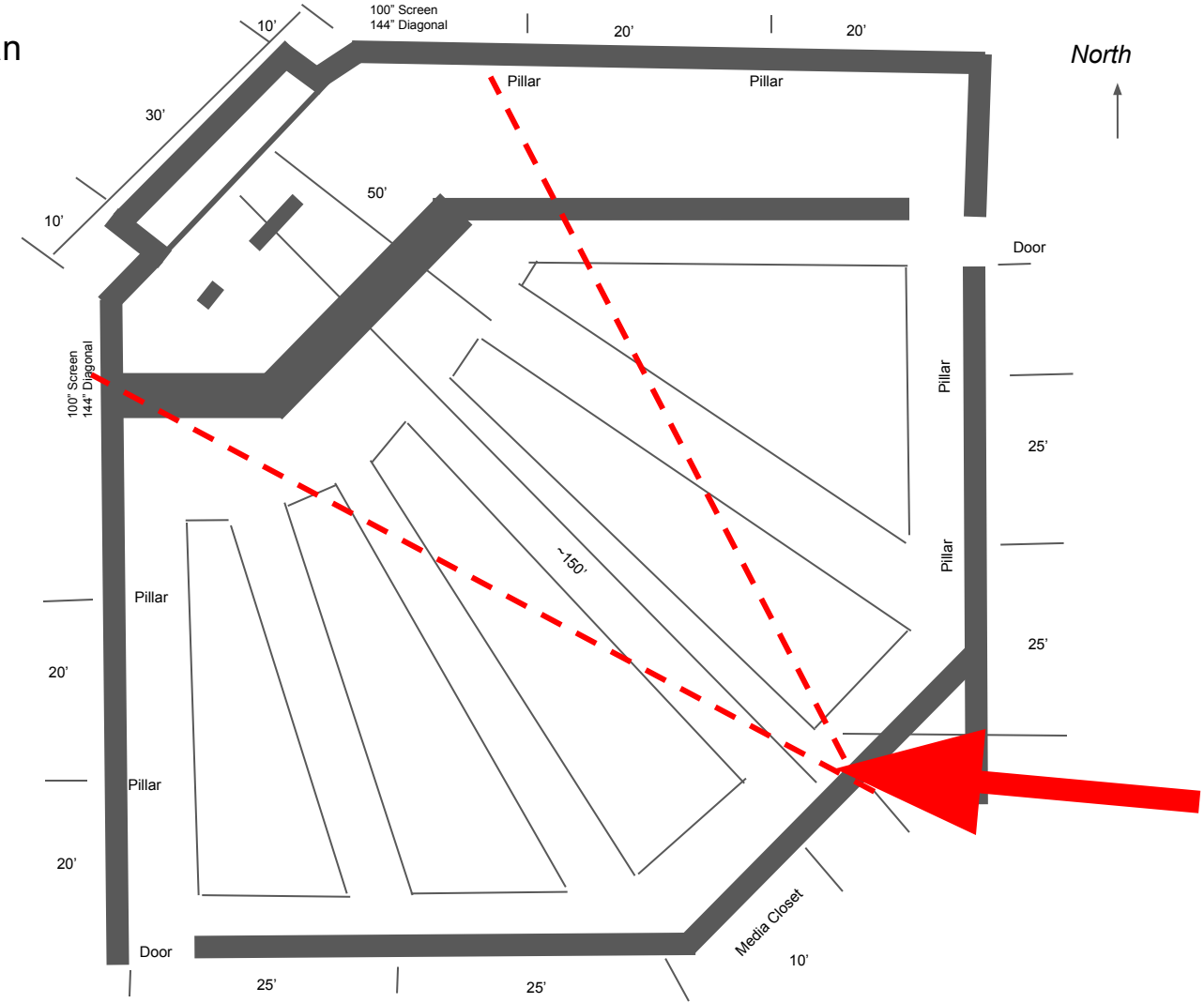
Plan for Projectors (on hold)

Utilize ProPresenter

- Grouped Large Screen Monitor Arrays
- Distributed Sanctuary Monitors
- May 2020
  - 65” 4K Monitor
  - ~$500
  - Plus Networking, Power & Mounting
- Status:WHD standard still in work
- Status: NDI solution available



Camera Plan



Present

Cameras are cable & battery intensive

Bring in Smartphones (rovers)

Future

Locate 3
Pan/Tilt/Zoom (1080p)

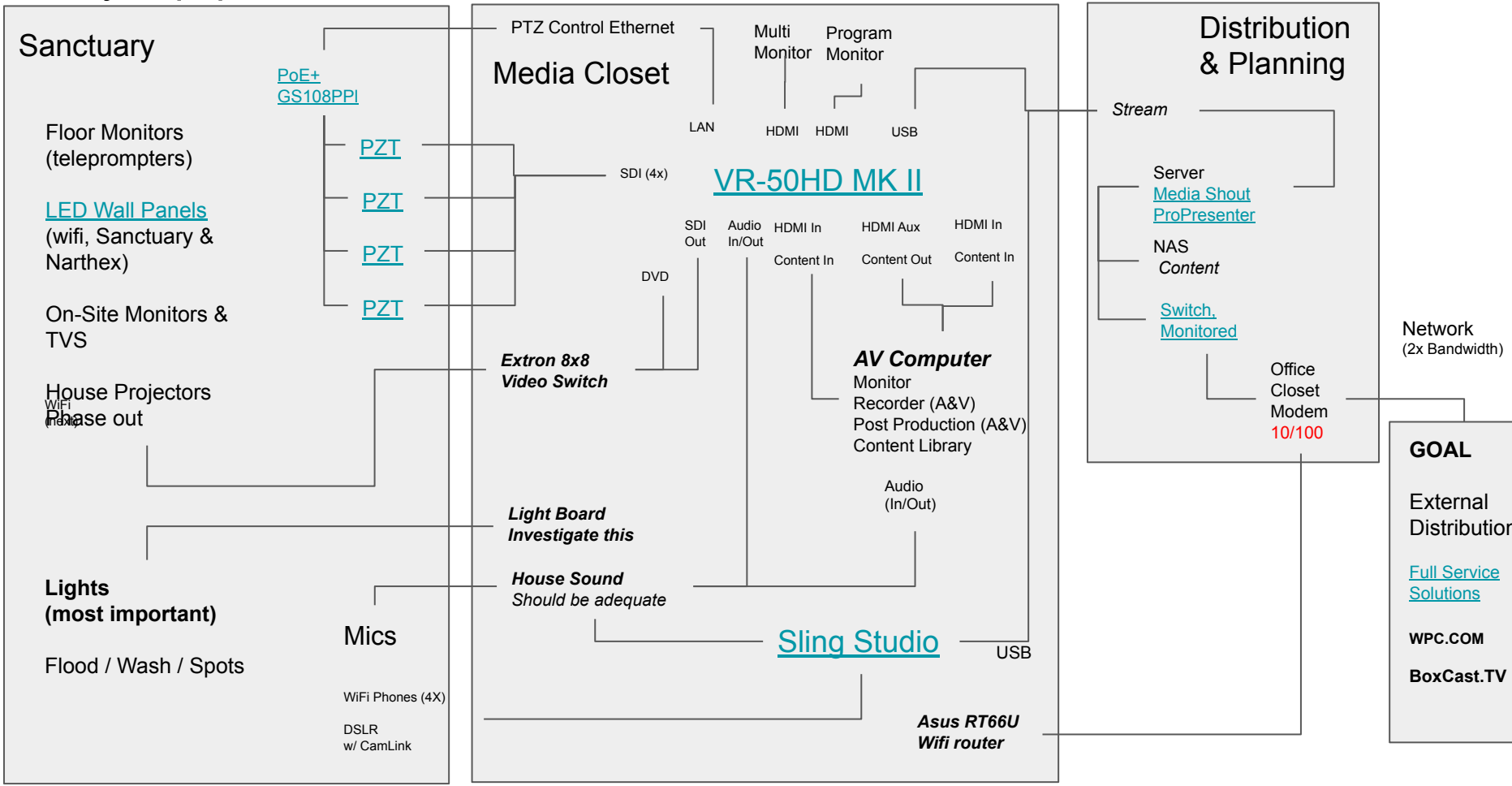
1 Wide angle
2 Zoom

NDI/Wifi/POE

Alternative

Use a 4k system needing only one camera

Early Equipment Plan



Interim Plan

- Sling Studio

All-in-one

Acceptable limitations

Livestream to FB or YouTube (not both)

Supports Post Production

Modest content insertion

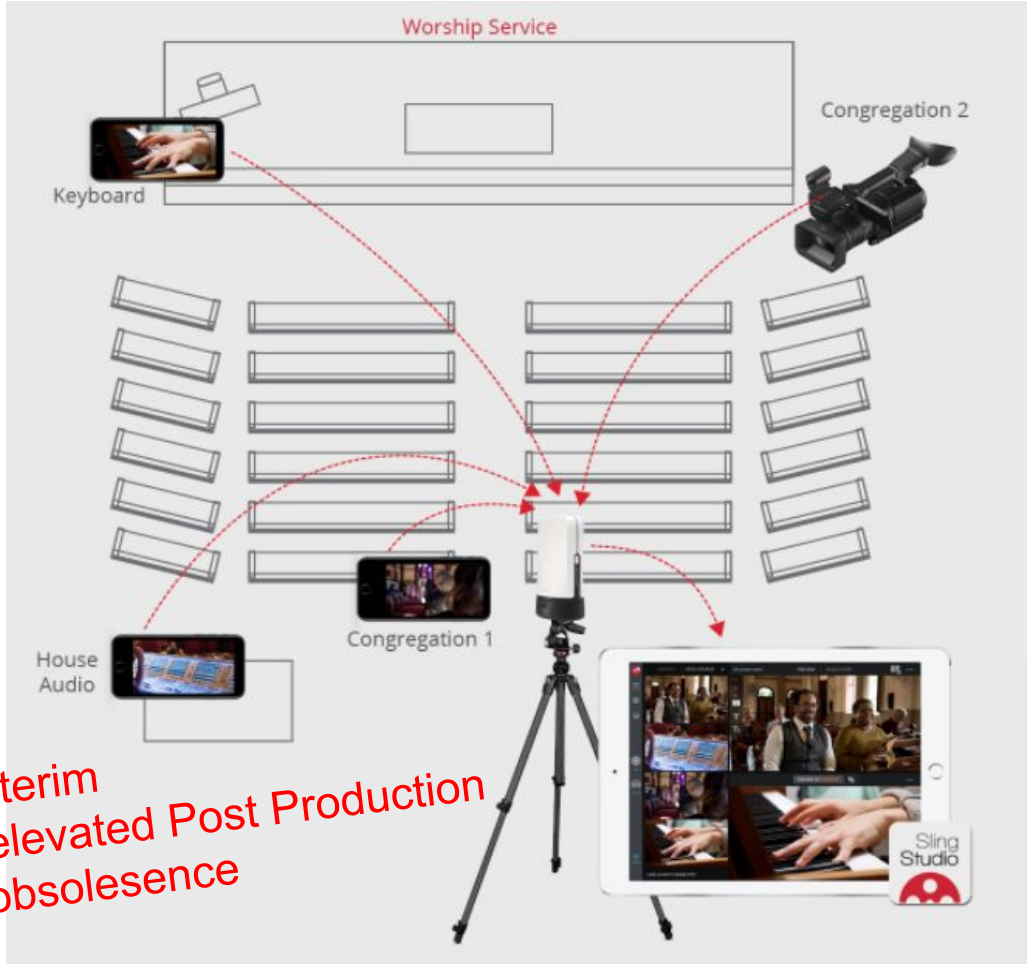
1080p Quality

Meshes with Final Cut Pro / Adobe Premiere

Designed for Smartphone cams

Should be operable by gaming kids

Unsupported (?) due to parent buyout?



Adequate for Interim
- Requires elevated Post Production
- Potential obsolesence

Website Plan

Websterpresby.org

Permanent Link

Start

Continually being refreshed

Our goal is to provide weekly worship videos, no more than 40 minutes long with music, pastoral prayer, time with the children, bible text, a short message, and a comment about stewardship. The services will be taped on Saturday mornings. So please look for a Saturday afternoon Constant Contact with the email link. In addition, several of us will be posting daily devotionals on the WPC Facebook page and on the WPC website.

May 10, 2020

- Worship Video
- Bulletin
- Hymn 2
- Hymn 543

May 3, 2020

- Worship Video
- Bulletin
- Hymn 507
- Hymn 305
- Hymn 54

April 26, 2020

- Worship Video
- Bulletin
- Hymn 306
- Hymn 336
- ICM Covid Response

April 19, 2020

- Worship Video
- Bulletin
- Hymn 15
- Hymn 22

April 12, 2020 Easter Sunday

- Worship Video
- Bulletin
- Hymn 268
- Hymn 232

April 11, 2020 Easter Parade

- Parade Video

Launch Page

In Revision

Suggest a refresh::

1) *Host music, finance and kid pics on WPC.com directly (reduces exposure on YouTube & FB) - Each week would be theme oriented*

2) *Links to hi-res spoken word (sans sensitive mtrl) to You Tube*

Network Plan - Copier Room

NAS for bulk storage
(~32gb / service)

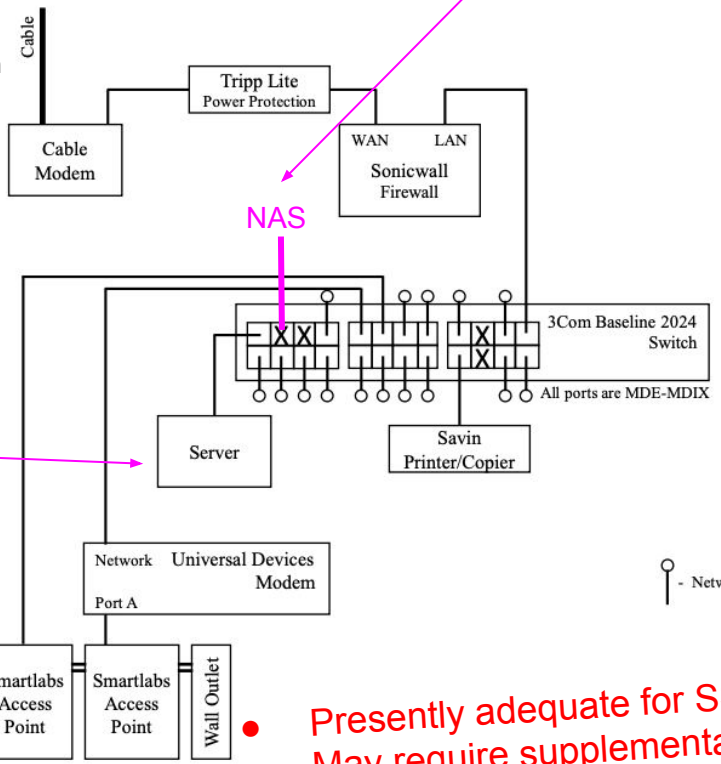
To BoxCast, FB, YouTube, etc

[Uploading Stream Guidance - Epiphan]

5 MBPS per HD stream

1080P at 8 MBPS
(SS 5/23/20)

85 MBPS down
25 MBPS up



This is 10/100

[Upgrade to Monitored Gigabit Switch]

Might have been done already

Install ProPresenter here and set up Remote Users (will this work?)

???????

Potential bottleneck
Look at this later

- Presently adequate for SS Interim
- May require supplemental “backbone” for future A/V schemes

Readings, Research & References

Reading - Overall

Everything You Need To Know About Video Production Costs (for Trustees, Elders, Board, Sessions)

Streaming Live Church Services: Comprehensive Guide Good reading

How to Livestream Your Church Service: A Practical Guide Practical/good

Church live streaming guide – learn to easily stream live church services

A Beginner's Guide to Church Live Streaming

Basic Gear to Livestream Your Worship Services

How can we livestream worship legally?

Be Safe, Not Sorry When Live Streaming Your Worship Services

What About Facebook Live?

Beyond Livestream Worship: What we learned from our experiment with online worship

7 Lessons from Singapore's Churches for When the Coronavirus Reaches Yours...

Copyright Issues To Keep In Mind When Live Streaming from Your Ministry

The Best Live Video Streaming Equipment for Your Church

The Ultimate A/V Event Planning Checklist

How Do I Budget for Our A/V/L Needs?

Audio/Visuals: What to Consider for Your Church Building Project

The Pastor's Guide to Audio, Video and Lighting

Video projection “fails”

AUDIOVISUAL BEST PRACTICES (Book)

Reading - Lights (most important)

The Ultimate Guide to Perfect Video Production Lighting

LED Lighting Optics and Beam distribution – Optical - Beam Angle, reflector and lens type (selecting your LED bulb)

Lighting Design and Instruments for Broadcast Television

TV Studio Slights

Must-Try Lighting Techniques for Your Worship Session

Lighting 101: Putting a Church Stage Lighting System Together

Best Stage Lighting for Churches

The Ultimate Guide To The Best Stage Lighting For Church

Lighting with LEDs

The Process: Lighting a Worship Service

Big Lighting Design, on a Small Budget (clever ideas)

Five Thoughts on Why Lighting Will Be the Next Worship War

Who Turned the Lights Out?

- Media Closet is crowded
- Existing overheads difficult to service/maintain
- Needs to integrate with future Sanctuary
- Existing hotcans are “hot”
- Simple vs programmable

Reading - Audio (extremely important)

Ready Your Church Audio for Live Streaming

Secrets to Great Webcast/Broadcast Audio

5 Easy Ways to Improve the Audio of your Church's Live Streams

- Media Closet is crowded
- Seeking future vision for House Audio Board

Hurdles: Location

Vision: Integrated A/V

Reading - PTZ Cameras

Best PTZ Cameras for Church Good discussion. Sole manufacturer (PTZ Optics)

PTZ Cameras for Church: Why Not FullHD? High end

The Best PTZ Cameras for Live Streaming

- Trades favoring NDI
- 4K camera could replace 3 HD cameras!

Vision:
- Easy to operate & replace
- Network connected

Hurdles: Wiring & A/V mixer compatibililty

Reading - Streaming Services

Software for Live Streaming Church Services

Top 10 Live Streaming Services for Church

7 Best Live Streaming Solutions for Your Church - 2020 Update

- New Battlefield
- Lots of players appearing
- SlingStudio -> Sling TV -> Direct TV -> 24/7?

Hurdles: Accessibility

Vision: A 24/7 channel

Reading - LED Walls

Choosing the Right Digital Display for Your Church

Video Display Options for Growing Churches

Flat Screen Monitors For Churches – Buyers Guide And Reviews (current)

Church LED Wall | LED Church Signs | LED Screen For Church (large custom projects

10 LED Walls that Deliver on Clarity (all discontinued)

https://electronics.howstuffworks.com/internet-tv2.htm

- Tentative locations located in Sanctuary
- Mount, tie into power, feed through wifi (house TV)
- Hold on this until sanctuary design determined
- Monitor Network/Wifi interface market
- Consider LED Multiscreens using ProPresenter7

Hurdles: Cost curve

Vision: Monitors everywhere

Data Point:
$115k, installed w/ controllers, processors, cables, h/w, flown
$5k, 5x20a 220V circuits 100’ from main panel
34’x17; (20 panels wide by 9 panels high, 3.9mm, 4k)

Research, Gear Survey - All In One A/V Mixers

Best All-In-One AV Mixer for Small Event Filming and Live Streaming

- Roland V-1200 HDR ($5000) - obsolete
- Roland V-600UHD ($12,000)
  - One 4K camera power
  - Inputs (4 HDMI & 2 12G SDI) Outputs (3 HDMI & 1 12G SDI)
  - LED display
  - Needs audio desk
- (lots of others)
- Roland VR-50HD MK II ($2500-6485, price jumped)
  - PTZ control over LAN (up to six JVC/Panasonic)
  - *Support for Sony, PTZOPtics, Avonic and VISCA compatible will be available in a future update.
  - 8 Track audio desk
- Roland V-8HD ($2000)
  - Box only - 8 HDMI in, 3 out
- Roland VC-30HD ($1500)
  - Box only - 1 video in (component, sdi, hdmi), LR audio (XLR) in, 2 out (firewire & USB)
- Roland VR1-HD Streaming Mixer ($1095)
  - 3 HDMI in, USB 3.0 out
- Sling Studio
  - 4 wifi cameras (w/ Camlink)
  - 1 audio in
-

If we wait long enough, 4K systems should drop in price and simplify the setup

Integrated-Multibrand offers lower entry cost, higher aptitude operator

NDI is the future over SDI

Shying away from proprietary environments (i.e. ATEM)

Hurdles: Proprietary systems

Vision: Affordable Tech advances

Research, Gear Survey - PTZ Cameras

PTZ Cameras

Must:

- Be Smooth
- IP connected (Network Device Interface, NDI)
- Work with Roland Desk (else a standalone PZT control desk is needed)

Candidates

JVC
JVC Pro Product Overview Page
JVC KY-PZ100 Robotic PTZ Network Video Production Camera (Black) ($2500 each)

Panasonic:
AW-HE40SW/SK/HW/HK | PTZ Camera Systems | Broadcast and Professional AV | Panasonic Global ($2500 each)

PoE+*1

PTZ Optics - NDI (not compatible with Roland Desk yet)

These reduce the need for operators

If we wait,4K technology “could” replace our needs for 3 cameras with One

Some are still SDI (existing house wiring) - Would need ring out for R&R with prior instruments

Hurdles: Closed systems

Vision: NDI/Remote

Research - Encoders

Encoder (others)

- A Guide to Video Encoders for Live Streaming
- CamLink Capture Card
- Black Magic Web Presenter ($495)
    - HDMI In, USB 2.0 stream out (to live stream)
    -
- Black Magic H.264 Pro Recorder ($495)
    - In (HDMI Video, HDMI Audio, component / USB 2.0 Out
    - Black Magic s/w, Media Express S/W
    - Mac/Windows 10
- Teradeck (one per camera?)
- Teradek VidiU Go ($1611)
    - 1 HDMI in, Ethernet Out
- Teradeck VidiU Pro ($800)
- OBS (Open Source)
    - S/W Encoder
-
- Elgato (gaming environment)

Good affordable items, requires additional h/w to fit in
Looking at All-In-One packages (i.e. Roland or SlingStudio or ATEM)

Hurdles: Proprietary solutions / Training / Obsolesence

Vision: Integrated solution

Old sketches

Implementation
Lights
Not to scale

It was here I became informed of the “future sanctuary” power point. There are too many unknowns and this is where we stopped...

Description & Specs

Most important element
Existing light cans are too hot

Front Fill
Sevin LED floor lights
Locate LED floor lights under 1st row of pews
Install floor lights in to modified alter/pew

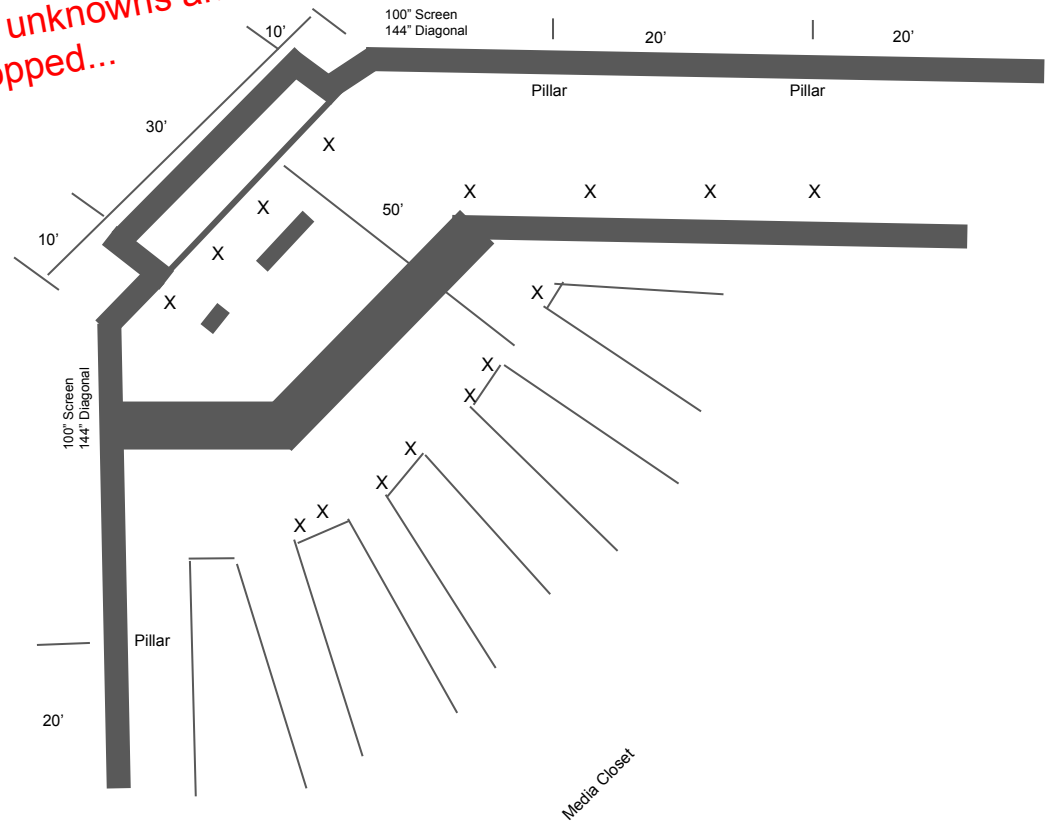
Must reach >50’
Must match natural light (no monochromatics)
No remote control

Back Lights
Wash out shadows created by fronts
Start with four (or equivalent)

Spot Lights
Pulpit
Altar

Future
Music Pit

Power

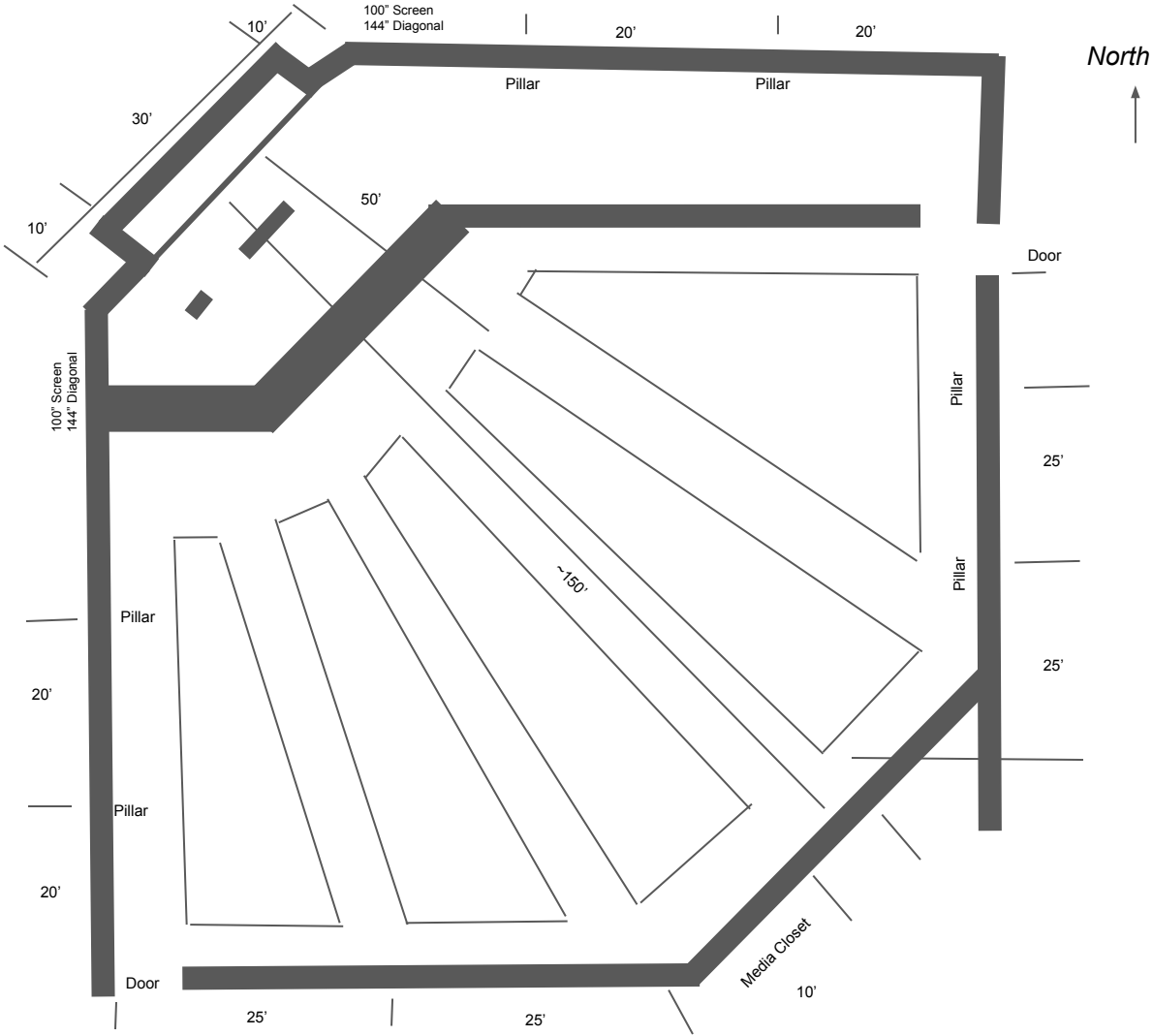


Sketch - Not to scale

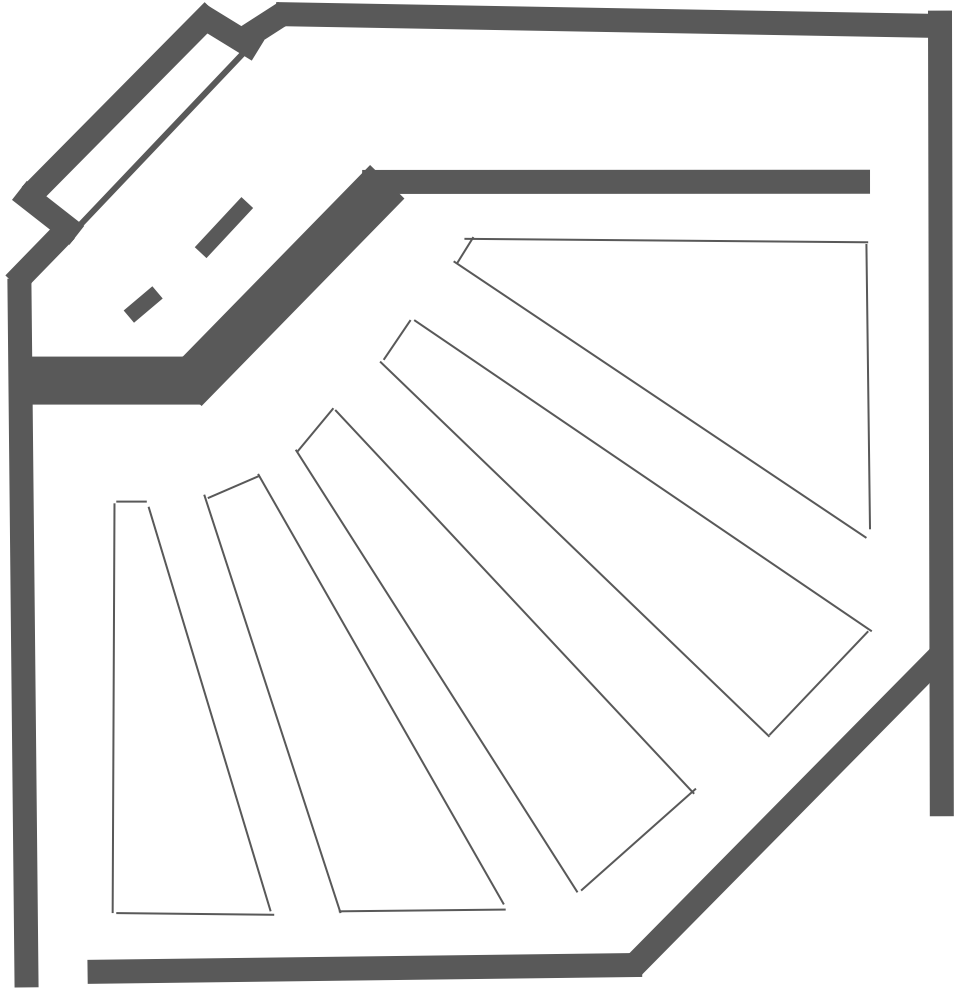
It was here I became informed of the “future sanctuary” power point. There are too many unknowns and this is where we stopped…

Locate LED walls above pillars for power access (feed signal through wifi.

Feed using ProPresenter



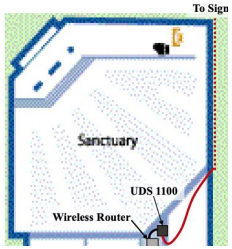
Sketch - Not to scale



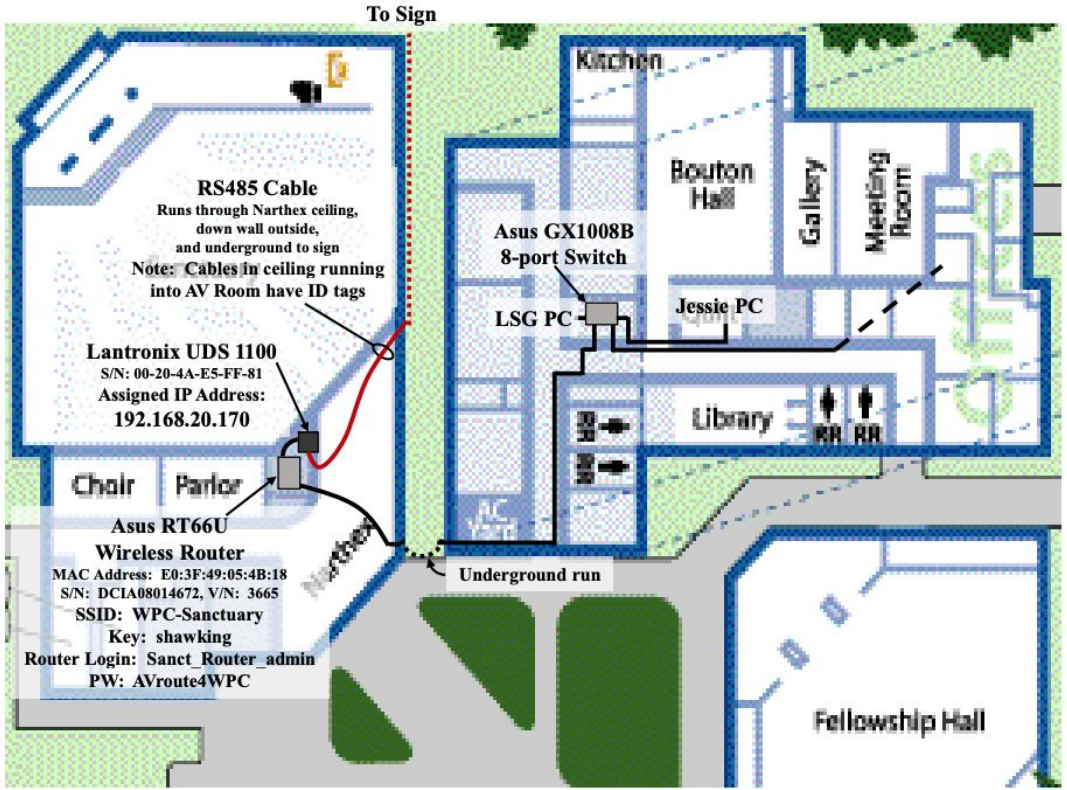
North

It was here I became informed of the “future sanctuary” power point. There are too many unknowns and this is where we stopped...

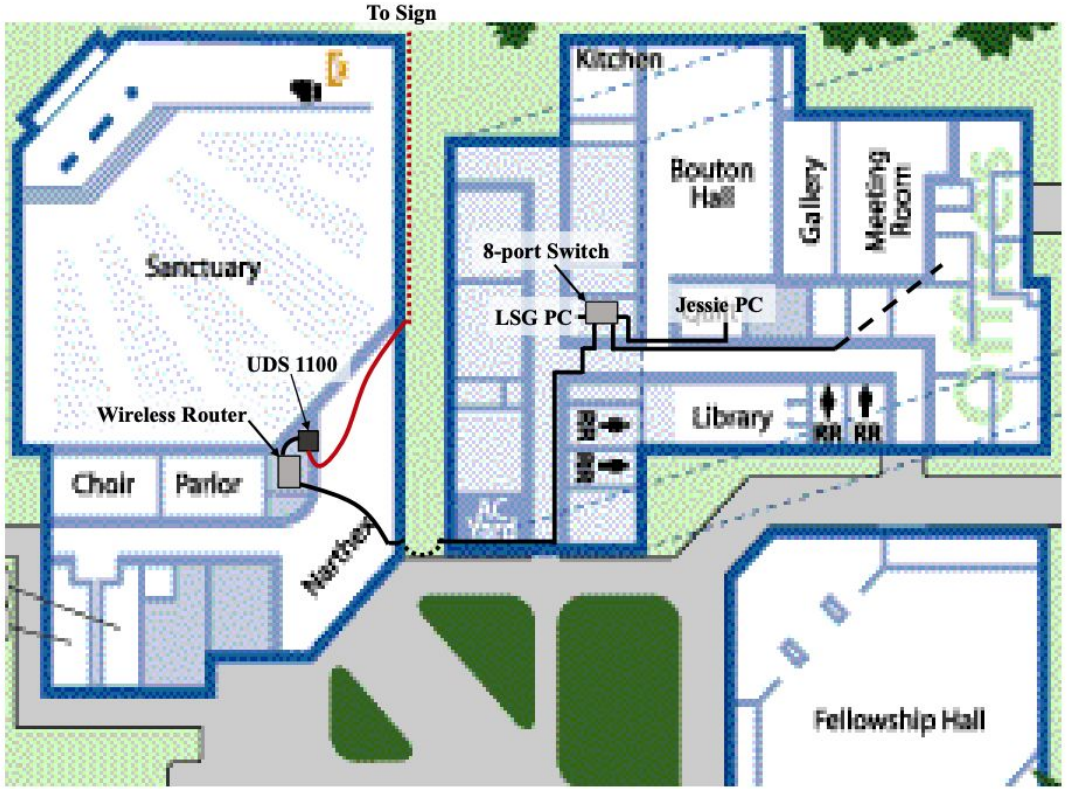
Lifted from



Reference


To Sign
Kitchen
Bouton Hall
Gallery
Meeting Room
RS485 Cable
Runs through Narthex ceiling, down wall outside, and underground to sign
Note: Cables in ceiling running into AV Room have ID tags
Asus GX1008B 8-port Switch
LSG PC
Jessie PC
Lantronix UDS 1100
S/N: 00-20-4A-E5-FF-81
Assigned IP Address:
192.168.20.170
Library
RR
RR
Choir
Parlor
Asus RT66U Wireless Router
MAC Address: E0:3F:49:05:4B:18
S/N: DCIA08014672, V/N: 3665
SSID: WPC-Sanctuary
Key: shawking
Router Login: Sanct_Router_admin
PW: AVroute4WPC
Narthex
Underground run
Fellowship Hall

Reference


To Sign
Kitchen
Bouton Hall
Gallery
Meeting Room
Sanctuary
8-port Switch
LSG PC
Jessie PC
UDS 1100
Wireless Router
Library
RR
RR
Chair
Parlor
Narthex
AC Vent
Fellowship Hall

Present Arrangement

Altar & Tapestry towards the back

Piano, speakers & singers down on floor level

Pulpit not used

Two fluorescents & lightbar - still nonuniform lighting

Two Audix mics - Increasing road noise during speakers

Lighting - Downselect

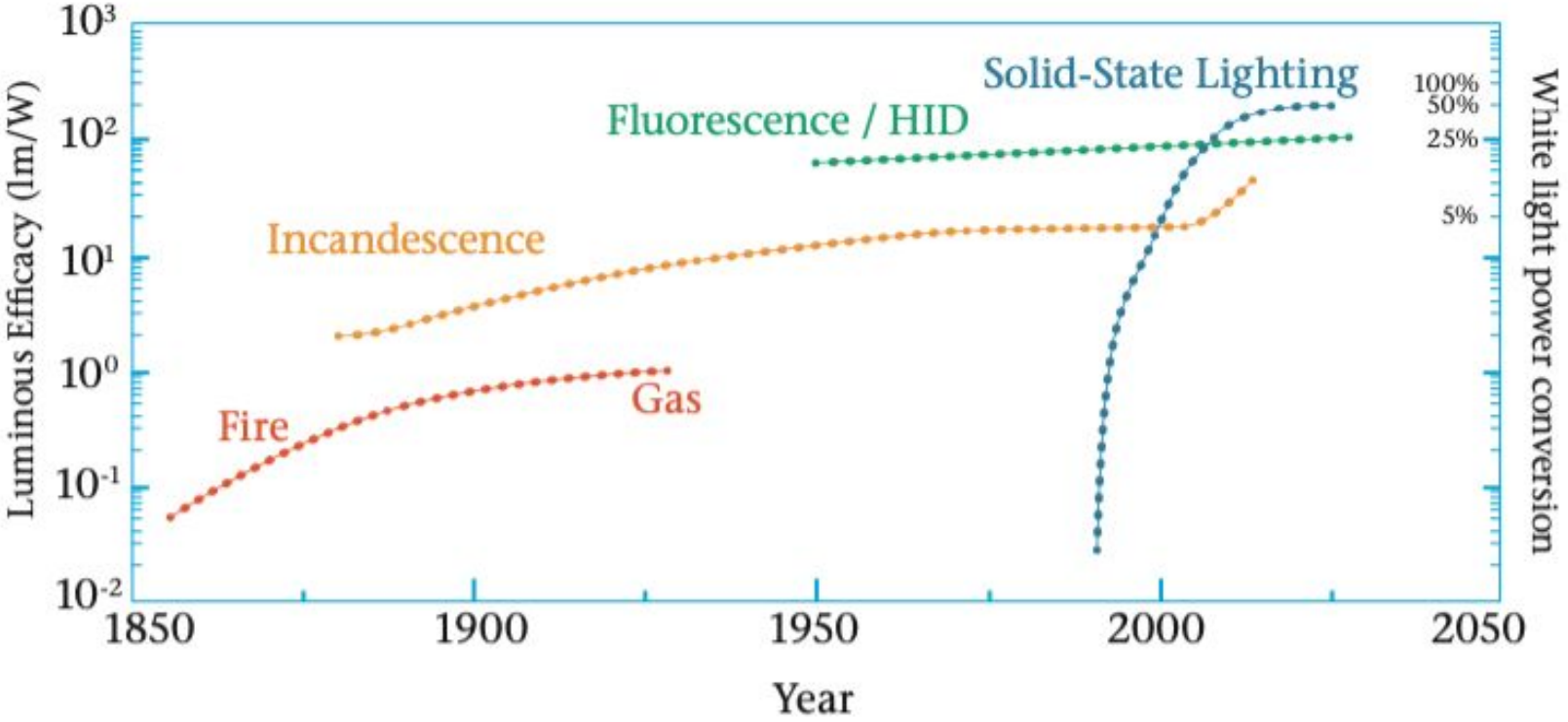
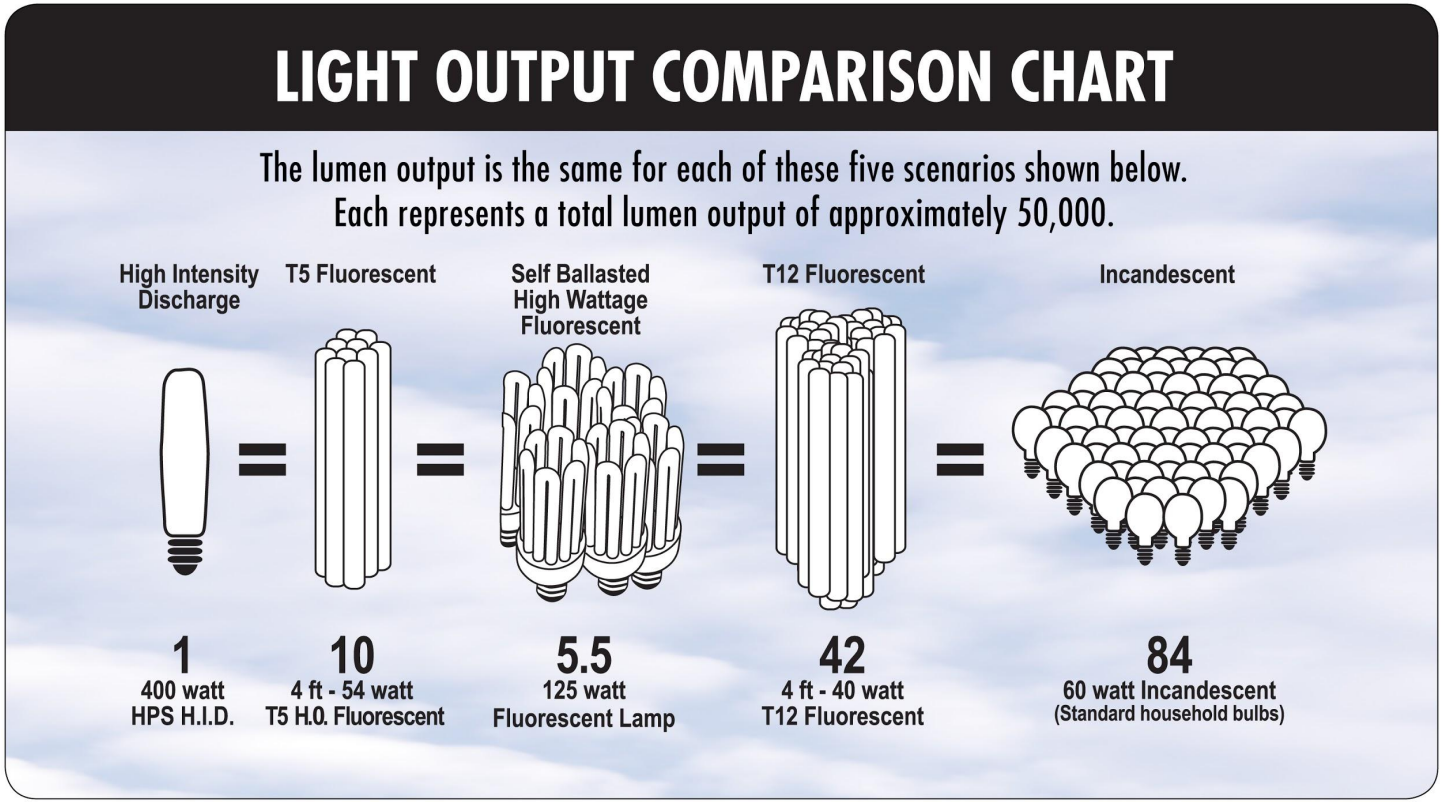


Figure 28. Improvements in luminous efficacy for light sources between 1850 and beyond 2011

Lighting Tables



BULB \ BRIGHTNESS	450 lumens	800 lumens	1100 lumens	1600 lumens	2600 lumens	5800 lumens
 LED	6W	9-10W	13W	16-18W	24W	45W special high voltage lamps
 CFL	8-9W	13-14W	18-19W	23W	40W	85W
 Regular Incandescent	40W	60W	75W	100W	150W	300W
 Halogen	29W	43W	53W	72W	150W	300W

More light

Equivalent Wattages and Light Output of Incandescent, CFL, and LED Bulbs

Light Output	LEDs	CFLs	Incandescents
Lumens	Watts	Watts	Watts
450	4-5	8-12	40
750-900	6-8	13-18	60
1100-1300	9-13	18-22	75-100
1600-1800	16-20	23-30	100
2600-2800	25-28	30-55	150

Metal Halide

Foot-Candles Received from varying distances.

This chart is in reference to the amount of light, not heat.

Lumen Output Of Bulb.
Wattage Of Bulb.
Inches From Bulb.

	5,500	6,500	14,000	20,000	36,000	110,000
	70	100	175	250	400	1,000
3	28,011	33,104	71,301	101,859	183,346	560,225
4	15,756	18,621	40,107	57,296	103,132	315,127
5	10,084	11,918	25,669	36,669	66,005	201,681
6	7,003	8,276	17,825	25,465	45,837	140,056
7	5,145	6,080	13,096	18,709	33,676	102,899
8	3,939	4,655	10,027	14,324	25,783	78,782
9	3,112	3,678	7,922	11,318	20,372	62,247
10	2,521	2,979	6,417	9,167	16,501	50,420
11	2,083	2,462	5,303	7,576	13,637	41,670
12	1,751	2,069	4,456	6,366	11,459	35,014
13	1,492	1,763	3,797	5,424	9,764	29,834
14	1,286	1,520	3,274	4,677	8,419	25,725
15	1,120	1,324	2,852	4,074	7,334	22,409
16	985	1,164	2,507	3,581	6,446	19,695
17	872	1,031	2,220	3,172	5,710	17,446
18	778	920	1,981	2,829	5,093	15,562
19	698	825	1,778	2,539	4,571	13,967
20	630	745	1,604	2,292	4,125	12,605
21	572	676	1,455	2,079	3,742	11,433
22	521	616	1,326	1,894	3,409	10,417
23	477	563	1,213	1,733	3,119	9,531
24	438	517	1,114	1,592	2,865	8,754
25	403	477	1,027	1,467	2,640	8,067
26	373	441	949	1,356	2,441	7,459
27	346	409	880	1,258	2,264	6,916
28	322	380	819	1,169	2,105	6,431
29	300	354	763	1,090	1,962	5,995
30	280	331	713	1,019	1,833	5,602
31	262	310	668	954	1,717	5,247
32	246	291	627	895	1,611	4,924
33	231	274	589	842	1,515	4,630
34	218	258	555	793	1,427	4,362
35	206	243	524	748	1,347	4,116

Too Close To Bulb.
Optimal Distance Range.
Too Far From Bulb.

Lighting Downselect

Luminaires and optical systems

Performance Criteria for TV lighting

The matrix presents the main performance criteria for different TV Production Lighting technologies.

A simple "traffic light" colour system has been used to show the results and highlight which technology performs better on each one of the performance and operational parameters.

It is apparent that cost is the main barrier to the implementation of low energy technologies such as LEP and LEDs.

	Dimming	Colour rendering	Beam throw	Beam control	Warm-up time	Lamp life	Energy consumption	Luminous efficacy including optics	Cost	Appropriate applications
Tungsten Incandescent			more energy required for bigger distances		no warm-up time	~100 - 1,000 hours	luminous efficacy is too low	~ 10 lm/W		key lighting
Tungsten Halogen with good optical design / HPL			more energy required for bigger distances		no warm-up time	~ 100 - 2,000 hours	possible to switch on instantly, good for energy management	~ 20 - 30 lm/W		key lighting
Discharge CDM	mechanical dimming	good with ceramic metal halide lamps	excellent with big distances	good, but mechanical dimming can interfere	~ 1 - 5 minutes	~ 500 - 15,000 hours	dimming and warm-up time have a bad implication on energy management	~ 50 - 90 lm/W		key lighting moving lights
Discharge short-arc HMI/MSR	mechanical dimming	variable, depending on lamp type			~ 1 - 5 minutes	~ 400 hours	dimming and warm-up time have a bad implication on energy management	~ 50 - 80 lm/W		key lighting follow spot moving lights
Discharge plasma	only down to 20% but with colour shift, then mechanical dimming				~ 1 minute	~ 10,000 hours		~ 50 - 80 lm/W	cost is still high but could decrease with more widespread use	key lighting moving lights follow spot
White LED matrix	potentially good, but some unreliability at bottom of the scale	spectral distribution has local peaks	highly depends on optical design ad LED source	variable, depending on optical design	no warm-up time	~ 25,000 hours		~ 40 - 60 lm/W	cost is still high but could decrease with more widespread use	key lighting soft lighting
White LED chip	potentially good, but some unreliability at bottom of the scale	phosphor LEDs can provide continuous spectrum	highly depends on optical design and LED source, bigger sources for higher outputs	smaller sources provide better control / lenses	no warm-up time	~ 25,000 hours		~ 40 - 70 lm/W	cost is still high but could decrease with more widespread use	key lighting
Colour LEDs		not applicable	saturated colour can reach high intensity	lenses	no warm-up time	~ 25,000 hours		direct emission of saturated colours	cost is still high but could decrease with more widespread use	cyclorama effects set dressing
Fluorescent	only if specialist control gear used	possible to achieve Ra>90 with special lamps	difficult to achieve big distances, more lamps required, large luminaires	large source	~ 1 - 5 minutes	~ 8,000 - 20,000 hours		~ 70 - 100 lm/W		soft lighting cyclorama

Figure 6. Lighting technology performance criteria comparative matrix

Lighting

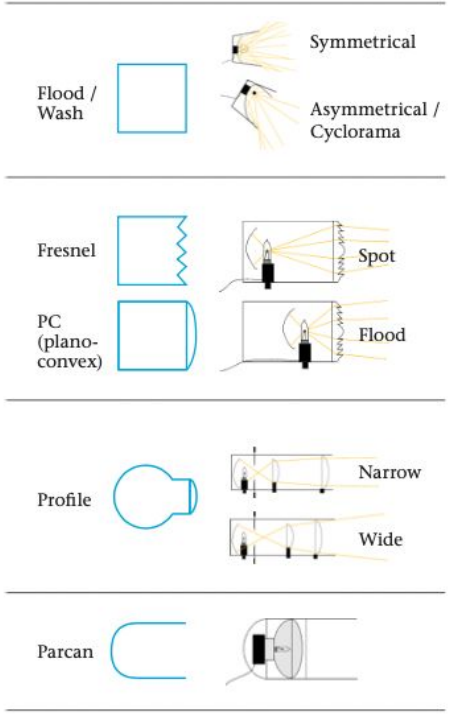


Figure 5. Main types of reflector and lensed TV and stage lanterns

Lessons Learned

Existing Overheads are becoming unaffordable to run

Procuring LED solution to costly at this time, will likely be obsolete by the time of the Sanctuary remodel

Recommend using existing Tungstens for backlighting

Recommend using additional Fluorescents - Attempt to get 2300K bulbs

Fluorescent lighting

With fluorescent lamps, **the light is emitted from a large surface and is therefore diffuse**. For this reason, in TV studios linear fluorescent lighting is generally used for soft lighting applications. Compact fluorescent lighting does not have significant application in TV studios.

The light colours of fluorescent lamps are **warm white**, **neutral white** and **daylight white**. Fluorescent lamps feature a **high luminous efficacy** and **long lamp life**. Although the emitted spectrum is discontinuous, **special phosphor compositions can produce good colour rendition** at the cost of slightly reduced luminous efficacy.

Fluorescent lamps are low-pressure discharge lamps that work using mercury to emit ultraviolet (UV) radiation that is converted into visible light by fluorescent substances deposited on the inner surface. An inert gas fills the tube making the ignition easier and controlling the discharge.

Electronic control gear is necessary to operate fluorescent lamps. They ignite immediately and reach their full luminous output after a short interval (from a few seconds to a few minutes). An immediate reignition is possible if the current is interrupted. Fluorescent lamps **can be dimmed smoothly** depending on the control gear and specialised flicker free dimming ballasts have been developed for motion picture applications. However, for TV applications, **dimming to less than half the lumen output produces a visible colour shift**.

Tungsten lighting

Tungsten incandescent and halogen lighting has dominated the broadcasting world for more than 50 years.

Tungsten lighting is very easy to understand because it is emitted by a thermal radiator that generates light by using an incandescent metal filament. By increasing the power and therefore the filament temperature, more light is generated, and viceversa by decreasing the power the light is dimmed.

As the filament temperature increases the spectrum of light shifts from the red heat of the filament to warm white light.

Characteristic features of tungsten lighting are **low colour temperature**, **smooth dimming**, **continuous light spectrum** and **excellent colour rendition**, **small size of light source** and **directionality of the light output**. Low voltage halogen sources require additional local transformers to operate, while mains voltage do not require additional equipment for switched operation.

Negative aspects of tungsten lighting are **low luminous efficacy** (between 10 and 20 lm/W, achieved with the more efficient HPL light source) **significant heat dissipation** (up to 95% of tungsten energy is dissipated as heat) and **short service life**.

Solid-state light emitting plasma

Light Emitting Plasma (LEP) include a solid-state device that generates radio frequency (RF) energy to power a plasma light source. They contain a very small amount of mercury compared with typical high-intensity discharge (HID) sources of equivalent power.

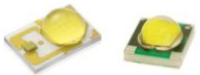
LEP sources are patented and manufactured only by the LUXIM company. They combine the **long service life** of solid-state lighting with the **high brightness** of HID sources.

Their **colour temperature is 5300K**.

LEP sources come up to full power typically within 30 to 60 seconds of turning them on and can re-strike within 60 seconds.

LEP lamps feature **high luminous efficacy** (up to 115 lm/W), **continuous light spectrum**, **high lumen output**, **good colour rendition** and **directional light output** due to the small light source size. The manufacturer claims the **ability to dim smoothly to 20%**, but **while dimming, the spectrum of light moves towards the blue end, lowering the colour rendering and increasing the correlated colour temperature**. For TV lighting, smooth dimming to 0% can only be achieved mechanically depending on luminaire design, similarly to discharge technologies.

Lighting



Solid-state LED lighting

Light emitting diodes (LEDs) are electroluminescent semiconductor sources. Light is generated by recombining charges in a semiconductor with an appropriate energy band gap.

Standard LEDs produce narrow-band radiation that appears to the human eye as saturated colour. For this reason initial LED applications have focused on *coloured light*. Coloured LEDs offer the **advantage of emitting coloured light very efficiently** if compared to using subtractive and dichroic filters with other light sources.

White light cannot be produced directly with semiconductor materials. Currently, LEDs can generate white light using two indirect methods:

- RGB mixing,
- Luminescence conversion.

RGB LEDs combine three coloured light diodes emitting red, green and blue light (RGB). The light colours can be mixed to produce a wide range of colours, including white, by adjusting their different light intensities. **The colour rendering of white light generated with RGB LEDs is generally poor**. But by using a higher number of coloured LEDs **it is possible to shape the spectral emission to create a continuous spectrum offering high colour rendering**. However this approach generally makes the light source dimensions bigger, with adverse effects on beam control.

LEDs producing white light with *luminescence conversion* typically convert the spectrum of coloured LEDs by using phosphors as a luminous layer. Currently, the preferred approach to produce white LEDs is to use blue LEDs with yellow phosphors coatings.

With this technology, it is possible to obtain better spectral distributions and **good colour rendering**, approximating R_a 90. The white light colours available include **warm white**, **neutral white**, and **daylight white** with colour temperatures between 2500K and 8000K.

LEDs can be extremely different in terms of colour characteristics, but also in their type of construction and form factor. The following LED shapes are used:

- *T-type LEDs* - They have a plastic housing with a diameter of 3-5mm for the wired LED. The shape of the lens determines the light emission angle. They tend to have low luminous flux, but some TV lighting manufacturers have used them in large arrays for soft lighting applications.
- *SMD LEDs* - The "Surface Mounted Device" (SMD) LEDs have soldered contacts and light emitting components glued directly to the circuit board.
- *COB LEDs* - "Chip on Board" (COB) LEDs have a protected sealed chip placed directly on a circuit board without its own housing.

High power SMD and COB LEDs have power consumption above 1W. In these LEDs, thermal management is a key factor because light is generated in a very small surface and their construction has very low thermal resistance between the chip and the circuit board. For this reason high-power LEDs are usually used over metal core circuit boards that **require special thermal management in the luminaire**. The output of the LED decreases with increasing temperature. Consequently, good heat dissipation is important for smooth operation.

Some LED fixtures are actively cooled with fans; this can cause problems in studios as they may generate noise.

LEDs used for lighting **do not produce UV or IR radiation**, but generally **contain more blue light than other sources** and this can make use of some filters problematic.

They are characterised by **compact shape** and **small form factor**, **extremely long service life** (50,000 hours according to manufacturers) and **high impact resistance**. For these reasons they are less likely to fail at a critical moment and need less maintenance.

They have **low energy consumption**; therefore their **luminous efficacy is high** (40 - 80 lm/W currently) and has been steadily increasing during the past few years.

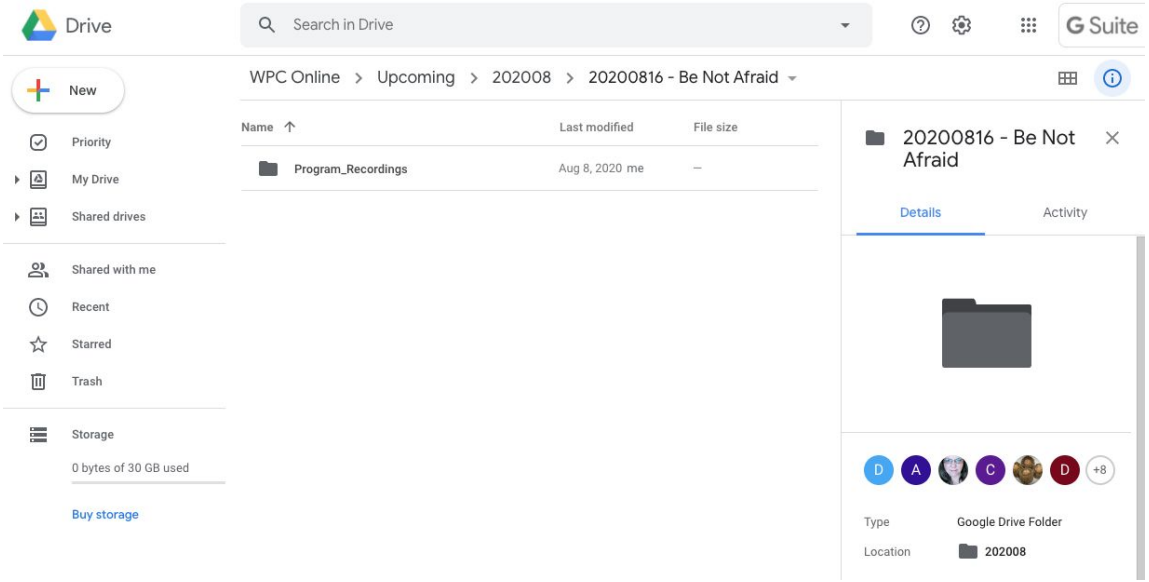
When dimmed, the **colour temperature remains constant as the light intensity decreases**. This can be positive or negative depending on the lighting application, but lamps including both white and RGB LEDs can mimic the behaviour of the colour shift created by tungsten dimming.

LEDs need **electronic control gear to keep the correct operating current constant**. They **start instantly - no warm-up time -** and **react quickly to dimming and control**.

Colour consistency and the reduction of production related colour deviations for LEDs is a particular challenge for manufacturers. They sort LEDs by luminous flux and dominant wavelength and give them a bin code and a rating. This sorting of LEDs is called binning and can be more or less precise depending on the manufacturer. MacAdam ellipses (see page 23) are extremely useful to understand the colour variance of LEDs within a certain luminaire model.

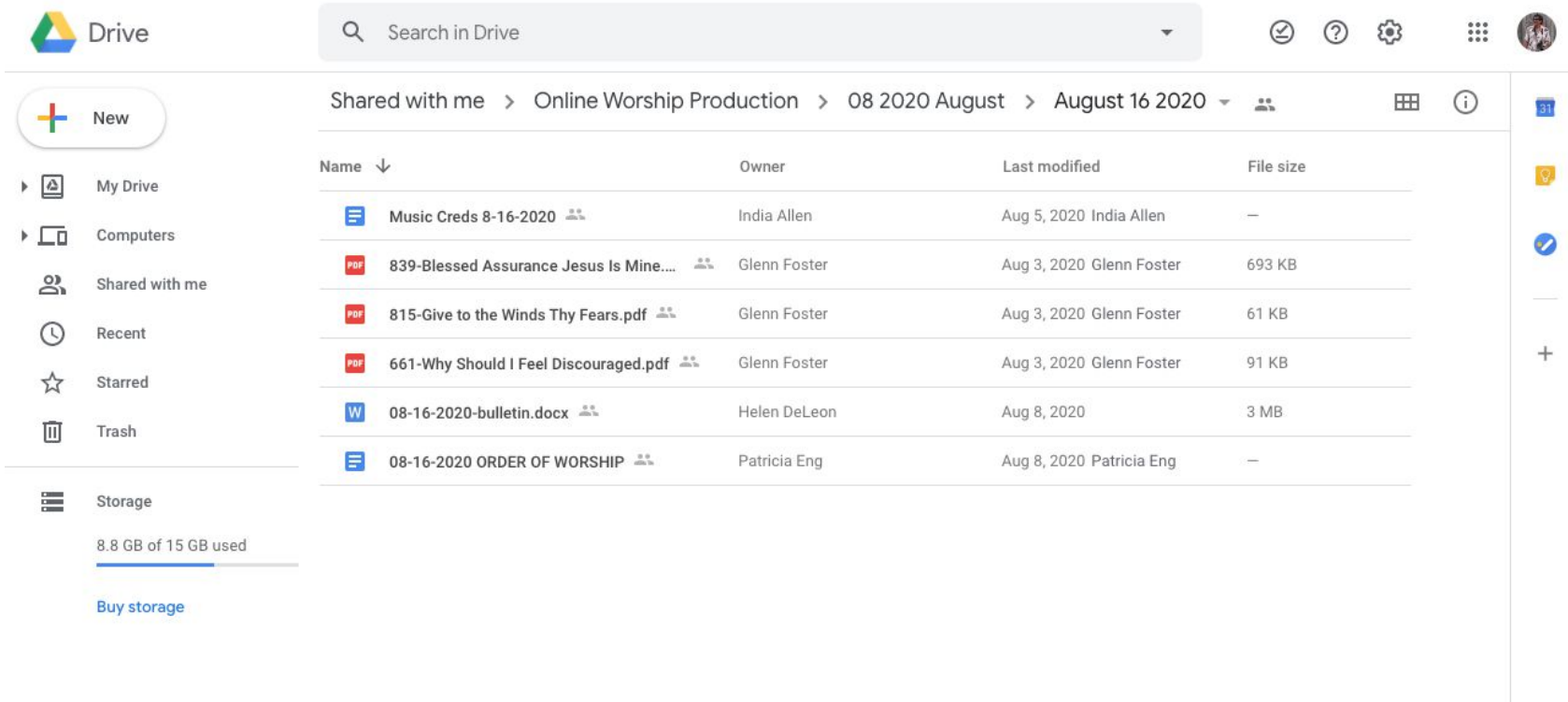
WPC Online

- https://drive.google.com/drive/u/1/folders/0ABV8R5d74xwxUk9PVA
- Set up for video collaboration
- 14 members
- Seemingly (?) unlimited storage



Online Worship Production
https://drive.google.com/drive/u/0/folders/1ENOqO9W8snIshOHYWs3-xgbBn24hgic5

Appears to be size limited
Appears to be where most people are going



School

SlingStudio Comprehensive Review: Wireless multi-camera streaming and recording device

Royalty Free Music
https://www.bensound.com/