The Church PA Handbook

“All of them were filled with the Holy Spirit and began to speak in other languages, as the spirit gave them ability. Now there were devout Jews from every nation under heaven living in Jerusalem, and at this sound the crowd gathered and was bewildered, because each one heard them speaking…”

The apostles had a good PA.

Introduction

Many churches have a PA: a public address system, and the falling price of modern electronics has brought a bewildering range of sophisticated equipment within the grasp of the most modest parish budget. This being the case, we might expect that any church service that we attend will be heard loud and clear, and that we will be able to understand the spoken word and enjoy and take part in the music. Often though, we find that the PA doesn't deliver this promise, and can even hinder our hearing the priest, readers and musicians. The reason for this of course, is that modern PA equipment is sophisticated and in order to get the best from it, a certain amount of training and a little time setting up the PA is required.

How to use this handbook

This handbook has been produced to support a basic Church PA training session given at the Northampton Diocese Youth Conference in October 2002. I hope, however, that as well as being a useful reference for those attending the session, it may also find uses elsewhere.

The handbook covers everything required from the basic "what's what" section through to how to use the various pieces of equipment, how to get the best in various situations that you're likely to come across, and how to deal with commonly encountered problems. I hope that there will be something useful for anyone in this handbook, but if you already know the basics, you'll want to skip over the early sections.

Please feel free to distribute the handbook to anyone who may find it useful, and you may consider leaving a copy on the pew of the next church in which you can't hear the readings! The handbook is available in electronic format at the Diocesan Youth Project website.

If you have any feedback about the handbook, corrections, or requests for additions, please email me at martin.campbell@baigent.net.

Martin Campbell

2002

Contents

What is PA?

The PA, or public address system is the means by a speaker or musician can be heard by a very large number of people. In the case of a church PA, this practically means a number of microphones, usually including a radio microphone or two, an amplifier, and various speakers situated around the church. Some church PA systems also include tape or CD players and various other items which we'll come to later.

When it's operating correctly, the PA enables a person standing or sitting in the congregation to hear the priest, the readers, and the musicians loud and clear. Because of the environment in which it's used, there are special considerations which mark out the Church PA from those used in other situations. For a start, Churches are often difficult buildings acoustically, having a very strong character of their own which makes it difficult to amplify things clearly. In addition to this, we need to bear in mind that whilst we need to hear the priest clearly during a service, the congregation also needs to join in with various prayers and parts of the service without being drowned out! This is equally true of music, we need to hear the music loudly and clearly enough to join in, but not so loud that we can't hear ourselves sing and not too quiet, so that the congregation drowns out the musicians.

The person who operates the PA in a church will often be the priest, the leader of the music group, or a willing volunteer more often than not, they will have little choice of equipment and will have to do the best possible job with the resources available.

The Vocation of PA

OK, so that might be overdoing it slightly, but whilst we take care of our Church buildings, flowers, vestments, readings music and prayers, the PA is absolutely essential in ensuring that we can hear the Word, the music, and take part in the service. The job of running the PA is almost always a thankless one, because when it's done properly, most people will not notice the PA itself. When a PA is badly set up though, the congregation won't be able to take full and active part in the service simply because they can't hear it properly.

What's what : essentials

This section deals with the basic equipment that's part of any PA system. If you're already familiar with this equipment, do skip on…

There are four essentials for any PA system, they take care of getting the sound in, making it louder, moving it around and pumping it back out again. In any existing PA system, you'll should find all of these in place, though there are many variations on the theme.

Microphones

The microphone is the starting point of the PA system. Some PA systems will have a collection of microphones, whilst some have only one.

There are two main types of microphone: **Dynamic Microphones** generate electrical signals directly from the sound waves that they receive, **Condenser Microphones** use a battery (or other power source) to generate turn the incoming sound into an electrical signal. The practical difference between these two is that dynamic microphones need to be held pretty close – around 5-15 cm - to the source that they're amplifying (the speaker's mouth or the musical instrument) whilst condenser microphones can be held much further away. Condenser microphones are used more for recording than for PA, so you're more likely to run into dynamic microphones in your church PA. The reason for this is that dynamic microphones are great at picking up sound that's very close to them and not picking up the other sounds from further away, which in our context means that you can amplify what you want and avoid amplifying what you don't want!

Many churches have a **Wireless Microphone**. This is a microphone with a radio transmitter that sends the signal to a receiver close by. Wireless microphones that are found in churches are usually of the sort with a small box, worn on the belt containing the battery and transmitter, and a small microphone attached via a short wire to be clipped onto the wearer's clothing. (The battery here is for the transmitter and doesn't mean that this is necessarily a condenser microphone)

Amplifier

The amplifier has the job of taking your sound and making it louder. The simplest of these just have a volume control, but you may find that the amplifier is able to take inputs from several different sources at the same time and combine them into the output (this means it has a simple built in mixer). This amplifier will be quite different from the one in your HiFi at home as it probably won't have much by way of tone controls or flashing lights, but it will be built to deliver a fairly high power output steadily and consistently for many years.

Usually in a church PA, the Amplifier will have been installed with the system and won't be touched from one week to the next. If the PA is set up right, that's not a problem, but if not, you may need to locate it in order to adjust the volume.

Speakers

Speakers are the noisy end of the PA, and in a church they're usually mounted on the walls or occasionally on the ceiling. Most church PA systems are mono (unlike your HiFi at home) so there may be just one speaker, but more often there are at least two, usually at either side of the front of the church and then at strategic positions around the church.

Wires

Wires form, quite literally, the final link in this chain in that they connect these other pieces of equipment together. We'll go into which wires are required to do what in a later section, but you will need to have the right ones and ensure that they're looked after properly, of trouble awaits!

What's what : optional extras

Having gathered or found the essentials, you'll be in a position to get the PA working, but you may also find that you have, or need, other equipment for various purposes, so I've described these in this section.

Mixer

Many amplifiers found in churches have a mixer built in which enables several microphones to be connected at a time and their sounds combined and played through the speakers. What these don't generally have, however, is much flexibility for controlling the way in which these sounds are combined, this usually being done by the company that installed the system and then not altered after that.

A mixer allows much greater control over the way in which sounds are brought together in the PA, and is really useful if you're amplifying a music group of any size. The mixer will allow you to plug in several microphones and/or instruments, control their volumes independently and also have a degree of control over the tone of each instrument as well. There are many different kinds of mixers, some especially designed for "live" work such as Church PA, and some designed for recording, which will have a lot of features that we won't require.

CD / Tape

Your PA may include a CD or tape player for playing pre-recorded music before, during or after a service, these probably resemble the CD or tape player in your HiFi at home and work in pretty much the same way.

Equaliser

An equaliser can be a very useful device for church PA, because it allows the overall tone of the sound that the PA produces to be controlled. You may find that your amplifier, or mixer if you're using one has a tone control or some form of equaliser, and you will be able to hear the difference that adjusting this will make. A stand-along equaliser can enable you to make some very precise adjustments to the sound, and to control some problems, like feedback, which we'll come to later.

Induction loop

An induction loop is a piece of equipment which is widespread in churches. Usually it's built into the system and linked to the amplifier. What it does is to take the output from the amplifier and transmit it to a long loop of wire which runs around the perimeter of the church. Within this loop (and for a short distance outside), radio receivers, and more importantly hearing aids switched to the "" setting will pick up this radio signal and relay it to the wearers ear. This should have been set up by the installation company, and should be left alone!

Setting up

The chances are, that in a church setting, there will be a few standard arrangements which, once you've got them working, you'll be able to use time and time again. Many services will have just readers and the priest using the PA, then other services with a music group (usually a similar arrangement each time). It's worth taking a little time to get the setup working ideally, and after that you'll be able to set up in a matter of a few minutes each time it's required.

If you can persuade the music group to turn up half an hour early for a rehearsal, you can spend a little time with them getting the setup right so that you won't need to go through the same process each week. Of course you'll need to show up even earlier to set out the equipment and get everything plugged in. The first time you do this you'll need to allow a decent amount of time, maybe up to an hour to get everything set up, plugged in and checked. Once you're familiar with the setup however, you'll be able to set out the equipment in a matter of a few minutes.

Arranging the people

The first task in getting the PA setup ready is to decide where people are going to go. Some of the people you're amplifying will be in fixed positions, readers and speakers, but for the music group you'll probably need to arrange them yourself.

Usually, you'll be limited by the confines of the Church or room that you're in, and you'll need to take account of fixtures, pillars, fixed pews and a host of other obstacles. The first consideration when organising a group of musicians and singers is to ensure that they can all see the conductor or leader, ideally they'll also be able to see the priest and readers – they may be musicians but they're still taking part in the liturgy. Next, try and group the singers in one group and the other musicians in another group, these two groups will work better if they're kept together and next to each-other.

Singers are very flexible in their arrangement, you'll need to keep people singing the same part together, and you may want to keep adjacent parts next to each-other as well, tenors next to basses etc.

Instrumentalists are a little more difficult to arrange, for a start they need a little more room (depending on the size of their instruments!). Some practical considerations will need to be considered first:

- Drums are usually placed at the back of the music group, this is mainly because they're so large – especially if you have a drum kit - but the other benefit is that drums have a natural tendency to come "to the fore" so keeping them towards the back of the music group will help to keep their volume reasonable and also ensure that the rest of the musicians can hear them well.
- Instruments with their own amplification will probably need to go towards the back of the music group as well, the bass guitar and electric guitar may have their own amplifier which will be fairly large, and which the other instrumentalists will need to be able to hear clearly.
- The relative size of instruments does come into play at this point, it's no accident that in an orchestra, the smaller instruments tend to be placed towards the front, and one reason is the simple practical one that it's easy for the tuba player to see past the flautist than the other way around!
- You may wish to think about the experience that your different musicians have when arranging them at this point as well. An inexperienced

musician will more comfortable next to a more experienced one, so if you are able to arrange things in this way, they'll be grateful. You may also want to arrange matters so that your musicians of higher standard are placed more to the fore, and closer to microphones, but you'll need to use your skills of diplomacy for that!

- The final consideration that you might want to make is that of the musicians seeing each-other. In a small group, you probably won't have the luxury of a conductor, so your leader will be one of the musicians. A small group will be able to play together better – and keep time better – if they can see each-other.

What to amplify

It's easy to get carried away with PA, and amplify everything in sight. Our ultimate aim however, is to ensure that the congregation can hear the music or speaker, so it's not always necessary:

- Loud instruments (you know who your are trumpets and drums) will not need amplification.
- If you have an abundance of guitars, you might choose to just amplify your leader, or perhaps none at all!
- Instruments such as woodwind – flutes, clarinets, etc. can be played loud enough not to need amplification in most circumstances, but if you have quiet players or a large space, you might need to amplify them if you can't hear them.

Arranging the equipment

I've already mentioned the points to bear in mind when setting up. You'll be governed by the space that you have available and by what the musicians want to do, but there are a few other things to bear in mind:

- You're going to end up with a few wires around the place – make sure that wires don't cross walkways and are firmly fixed down so that they can't trip people.
- You'll need access to whatever you're using to control your PA – usually a mixer, during the service in order to adjust the volume, and silence any unwanted sounds, so make sure that you can get to it if at all possible.

Connecting it up

Connecting it up is a job which, once you've taken a bit of time to look at initially, should be pretty straightforward each time you use the PA. If different people use the PA, however, or if you use it infrequently, it's useful to label all the wires to indicate where they plug in to each-other. The company setting up the equipment for you, or the instruction manual will tell you how to plug each item into the next, and the list below gives you a list to work through:

- Microphones, do these first. They will usually have a lead that plugs straight into them. This is usually a three pin cable with a chunky round connector called an XLR connector. Plug the microphone into the lead and then make sure that the microphone has a battery fitted if required and is switched to the "on" position.
- The other end of the microphone cable (once you've untangled it) will then plug into your mixer (or amplifier). Make sure you remember which connection corresponds to which microphone – again labels are useful!

- Then take a look on the mixer at the channel strip which corresponds to the plug you've just inserts. For example, if you plugged the microphone into "MIC1" on the back of the mixer, you'll need to look for the vertical strip of controls marked "1" on the front of the mixer. These are normally arranged from left to right across the mixer and can have several controls on them. You'll need to refer to your manual to see what the mixer actually does, as they vary hugely, but when setting up your mixer, having just plugged in a mic, check the following:
    - Check that the channel is set to use the mic input that you've just used, some mixers have other inputs.
    - Check that the input level (usually at the top of the strip) is set correctly for a microphone – you can adjust this using the solo(PFL) button if your mixer has one in a moment.
    - Check that the equaliser is set flat – i.e. knobs are vertical.
    - Check that the fader (the slider at the bottom of the channel) is fully down.
    - Check that the channel is enabled (if you have an "enable" button)
    - Check that the channel isn't muted (if you have a "mute" button)
    - It sounds like a lot, but it will only take a moment for each microphone once you've worked out what everything does!
- As well as microphones, you might also need to plug in other instruments, perhaps a bass guitar (though most church PAs would struggle with too much bass) or more likely an electro-acoustic guitar. In order to plug in any instrument, you're going to need a DI (Direct Inject) box. This converts the low strength signal that the instrument gives out, into one strong enough for the mixer to use. You plug the instrument into the input of the DI box, and plug the output of the DI box into the mixer. Note that if you take a signal from another amplifer – perhaps a guitarist's own, you won't need a DI box – only if you go straight from the instrument itself.
- You'll then need to plug the output of your mixer into your amplifier – again this varies, so find out from the installer or manual how it's done.
- You can then power up your mixer (first) then your amplifier (don't worry about the order if you're plugging into a permanently installed amplifier.
- If you have headphones that you want to use to check the various levels and sounds, plug these into the mixer – they'll need to be the enclosed type not "in ear" or "open back" otherwise you'll hear the "real" sound much louder than the headphone sound!

Making sure it works

First let's check that everything's working properly.

- For each microphone, have someone make a noise in front of it (reading a newspaper or reciting the 5 times table is fine!). Tapping the front of microphones to see if they are on is not recommended as it will damage the microphones.
- Once someone is making a noise in front of the microphone, slide up the fader for that channel until you can hear the sound. You may be able to "solo" the channel on the mixer to hear it on the headphones and check it, so use this feature if you have it! You'll also need to turn up the master

fader (big one or two on the right) and the output level (if there is one) to hear anything.

- Once you've done this for each microphone and other instrument, you'll be ready to go, if you turn up all the faders, you should be able to hear all the instruments and microphones, if not, first check the settings on the appropriate channel of the mixer, then trace the cables back and check that the microphone or instrument is switched "on" (if appropriate).

Getting the sound - Sources

OK so the equipment is all connected and noise is coming out, but how do we make sure it's a good noise?

The priest and preacher

Voices are usually amplified in churches, but it's very easy to get this wrong. The most important factors are these:

- Microphone position: if you're using a clip on lapel mic, make sure that it's not going to get caught up in clothing as the wearer moves around, bear in mind the movements that the user will make during the course of the service. It's preferable to have the microphone a little further away than to have it disappear into folds of cloth whenever the wearer moves!
- Microphone technique: this applies if you're using a fixed microphone or hand-held microphone. The golden rule is to stay the same distance (about 30cm is good) from the microphone. If you're using a fixed mic, that means standing pretty still, and if you're using a handheld mic, well – be careful!
- After this, volume is what it's all about. You should be able to hear the speaker if you're sitting at the back of the congregation (not necessarily the back of the church) at a comfortable speaking volume. It's very easy to amplify voices as loud as you can but all this does is make them very uncomfortable to listen to!
- Those are the basics. If you want to use a compressor/gate, then good luck, and make sure you read and understand the instructions first.

Solo voice

Singers using microphones will need to follow the same techniques as above, with an additional consideration.

- When singing, the distance between the singer's mouth and the microphone is even more important, too close and every "P" and "S" sound will explode your listeners ears, too far away and it all sounds rather distant! Experiment to see what works, and make sure that your soloist is aware of how important it is!

Choir

If your choir can't be heard with out a PA, they need to sing up!. If you really need to amplify them, you'll need to use a good condenser mic (one with a battery) and have a mic for each 4 or 5 singers. This means that your microphones may have to be positioned in amongst other singers which can get messy!

Organ

Your church organ won't need amplifying, but if you have an electric organ or keyboard, you can plug it straight into the mixer.

Guitars

Guitars are often amplified, though they are quite loud in the flesh, so you won't need to turn them up much. If a guitar has an electric output (an electro-

acoustic guitar) you can use this (via a DI box), but if it's an entirely acoustic guitar, you'll need to use a microphone positioned in front of the sound-box (the hole) of the guitar, about 50 cm away.

Piano

A real live piano shouldn't need to be amplified, see above for keyboards.

Bass

A bass guitar really needs its own amplifier, as most PA systems don't have enough "bottom end" to do justice to a bass. Most bass guitarists will be used to this, and bring their own! Though you can't control the volume directly, don't be shy about getting the bassist to turn it up/down if that's what's required.

Woodwind

As mentioned before, you shouldn't need to amplify woodwind, but if you do need to, try and get the microphone around 30-50cm from the bit where the sound comes out (which with woodwind can be a variety of places!).

Percussion

Don't do it! They're loud enough as it is!

Brass

See percussion.

Getting the sound - Mixing

Balance – the Mix

Now you're in a position to get everything working together. You'll need your musicians / speakers for this bit, and you'll also need to make sure that you wander around the room and make sure that it sounds good throughout – you may find that you can hear different things in different parts of the room (i.e. lots of bass in one corner) so you'll need to adjust for that, though of course it will be a compromise overall. Adjust the relative volume of the microphones / instruments so that you can hear them all and no one leaps out above the others (unless this is your intention).

If you're checking the mix in an empty church, remember that once the room is full of people, your PA will need to be a little louder, as the additional people will soak up the sound. Also, the tone and character of the room may change – the only way to find out is to listen!

EQ / Equalisation

Having got your various instruments and microphones connected, you'll be just about ready to go. One thing that is worth doing is making sure that you use the equaliser/tone controls on each channel to make sure that the tone of each microphone/instrument is what you want. Of course this will vary according to your setup, but the one thing that you might want to do is to emphasise the part of each instrument that's the most important. With a bass guitar for example, we need to hear the bass, the middle and the treble end are not important, with a

piano, if we have a bass guitar as well, reduce the bass on the piano so that the bass and piano aren’t competing for the same part of spectrum.

Common problems

Too quiet

One of the most common problems. Adjust the individual volume if it's just one thing that's too quiet, or adjust the overall volume. If you're turning it up, watch out for…

Feedback

This is the whistling sound which occurs when too much of the sound which comes out through the speakers gets back to the microphone and goes around again getting amplified.

There are several ways to eliminate feedback:

- Switch off any microphones that aren't needed.
- Move the microphones – any that are in front of, or near speakers are probably causing the feedback.
- Turn down microphones which are needed, but are over-loud.
- Adjust the e.q. of the offending microphone : if the whistle is high pitched, turn down the "hi" e.q., if it's lower pitched, then try the "mid". Don't adjust these to extremes though or you'll find that your voices and instruments sound very strange.
- If you have a graphic equaliser, you can try and locate the feedback by pulling down faders in turn until you find it, but bear in mind that feedback does shift around as people and microphones move.
- If you have serious feedback problems, you may want to investigate using a "feedback destroyer". You friendly audio supplier should be able to demonstrate one of these to you.

Incorrect EQ (sounds "tinny" "boomy")

You should be able to adjust the EQ of the various instruments individually using your mixture, so if the overall mix sounds tinny, turn down the "hi" eq of those instruments that are at that end of the spectrum: guitars, flutes, vocals. If it's too boomy, turn down the bass on the piano and guitar.

Bear in mind that the sound of the room will change when it fills up with people!

Muddy mix – difficult to hear individual parts

This is a more difficult one to resolve, but check the following:

- Check your microphone position. If it's possible to move microphones closer to what they're amplifying, that will ensure that they pick up more of what you want and less of what you don't want.
- Check the EQ to make sure that you focus in on the most important sound from each instrument or microphone.
- Overall, remember that less is more, and that if you get in a real pickle, just turn everything right down and just bring out the few things that you really need to hear.

Hiss

Hiss is usually caused by having the treble turned up too high, or by having channels to which nothing is connected turned up – turn the treble to a more moderate level and mute anything that you're not using.

Hum

Hum is sometimes caused by instruments – electro-acoustic guitars can pick up mains hum quite badly. There's normally another setting that you can use to reduce this – a "hum-buckler", which might sound a little different, but will reduce the problem dramatically.

The other cause of hum is having instrument, or microphone cable too close to a mains cable. You won't have too many mains cables so concentrate on keeping them tucked away and away from the others and that should eliminate the problem.

The Room

It's unlikely you'll be able to do much to change the room that you're in. If it's too echoey, you might try placing a screen or blanket somewhere behind the musicians, or even moving the position of your musicians or speakers. Unfortunately, trial and error is your only route here!

More information

Having got this far, you'll have plenty to put into practice, but you may also need to follow up and find out more, especially if you're buying equipment. Your local music/PA shop will be a good starting point – anything with a large speaker in the window. To compare prices with some sort of benchmark, you can order a free "studiospares" catalogue from 0845 441020, and also speak to the very helpful pre-sales technical support if you haven't got someone closer to home!

I hope that you've found this manual useful. If you have any comments or areas for improvement, please email me at martin.campbell@baigent.net though I regret that I will not be able to answer specific queries.