

Guide to Sound

Although a written guide is no substitute for real experience, and can never really teach you how to design sound, this document aims to give you some basic information to get you started, and to share some hints and tricks which might save you a bit of time and heartache!

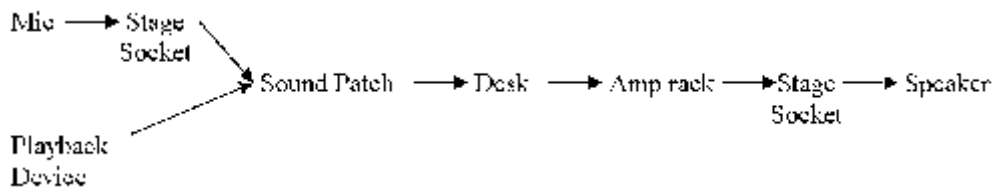
Although primarily concerned with the ADC Theatre, this Guide contains a lot of information which will be useful for Sound Designers at any venue.

The Big Book of Sound

The Big Book of Sound was written by many current and former ADC techies and contains a vast amount of useful information. Although much of the information is specifically about the ADC Theatre, many of the principles will be similar in any venue. Newcomers, in particular, should be warned that much of the information in the BBOS is more technical than the knowledge required to run shows successfully, so don't be put off by this.

The book resides in the sound box of the ADC Theatre.

The ADC Theatre Sound System



Places To Be

The Sound Box

Accessed through the Lighting box and situated at the back of the auditorium, this is where you'll be running the show. Here, much of the equipment lives and is used, so that the operator has easy access to the decks and desk during the show.

In addition this is where you'll find the Sound Patch rack, which is used to connect together the internal cabling which runs from input devices and to output devices. Patch leads hang next to the rack. It's important to know that the audience can hear you if you're talking during the show, so you should keep to a whisper.

The Sound Shelf

At the back of the Prompt Side of stage, up a ladder, this is where the spare speakers are stored and also where the Amp Rack lives. The amp rack contains the amps and is where speakers are patched into the internal wiring system which is connected to the sound box.

The Sound Shelf Cupboard

Most of the cabling of the ADC Theatre is fixed and internal, but the Sound Shelf cupboard contains all additional sound cable of the ADC, plus other useful sound equipment such as microphone stands, stage boxes and adapters.

The bar!

Equipment

Our current **sound desk**, a Soundcraft series TWO 24 channel desk is probably the most important piece of sound equipment in the building. 24 mono and 2 stereo channels, basic graphic equalization, 4 auxiliary channels and facilities to listen 'pre-fade' on either small sound box speakers or headphones are just a few of its most useful features.

The ADC Sound box also has 2 **minidisk machines** with facilities to play and edit on both, two **CD players** and a **tape deck**, to cater for any source of pre-recorded tracks. If you are using **microphones**, you will be able to borrow any of a number of different types from the theatre management. These include hand-held, instrument and radio microphones.

In order to get the best sound quality from microphones, it is advisable to use a **Graphic Equaliser (EQ)**. This is a far more sophisticated version of the 'Treble/Bass' knob found on many domestic hi-fis, and is used to reduce the amplitude of particular frequencies. For example, if you are trying to make something sound deliberately 'tinny' you can cut out the bass tones, leaving just the treble. Each channel on the desk has very basic 'EQ' (the black and white knobs), but the ADC Sound Box also has a Graphic Equaliser in the racks, which can be used to pinpoint individual frequencies more specifically. Although it is useful to create certain effects, the main purpose of this machine is to minimize Feedback (The Get-In: Feedback)

When added to a microphone signal, the **Digital Effects Unit** allows you to create a huge number of effects including reverb and echo – a great way to make the singer sound like they are in a church, down a well or somewhere in the Grand Canyon!

The **speakers** we use at the ADC are BOSE 802s. These have a broad angle (~120°), and just two are normally used to cover the entire audience, from the standard Front of House positions either side of the forestage. The ADC Theatre owns six Bose 802s, so you can also use the extra ones for foldback (speakers for the people on stage to hear what's going on) for the band, cast and Musical Director or for making sound come from a particular direction onstage.

You should always turn the amps off before the mixer and on after the mixer, to avoid damaging them. However, at the ADC Theatre, the **Sound Power On/Off switches** turn everything on and off in the right order automatically. These switches are located in the Sound Box above the digital effects unit, and at the back of the stage below the amp rack.

There are a number of sockets around the stage, auditorium and sound box labeled '**Sound Power Only**' sockets. 'Sound Power Only' sockets. These are wired into a separate feed, to prevent mains hum or 'noise' getting into the system, and you should therefore use them whenever plugging in extra sound equipment which is being routed through the speakers (e.g. keyboards and electric guitars). Adaptors for these sockets can be found in the sound shelf cupboard.

Sound Designing

Getting the Position

Almost every show needs some sort of sound output and therefore some sort of Sound Designer. On smaller shows, however, this requirement may be very small so the position of Sound Designer may

be combined with Lighting Designer and / or Technical Director.

The best way to find out about available positions is to get your address on relevant email lists. The 'Techies list', is the main technical list in Cambridge [[click here for more info](#)]. Other Cambridge drama societies will have their own lists, so try to get on your college's list too. [[click here for a list of other drama societies and how to get in contact](#)]. A few shows advertise for crew in the student press, but most of these will also use the Techies List.

Many Cambridge productions appoint without interviewing, so if you fancy a particular role you just need to send a short, informal email expressing your interest and perhaps listing one or two credits if you have any relevant experience. Available posts normally outnumber available noise boys, so if you aren't too picky you will normally be able to get something that interests you.

For larger scale productions, such as the ADC / Footlights Panto and many musicals, the Producers will open applications and interview applicants. Again, you will need to send an email application. Most or all applicants will be interviewed by a panel which may include the Producer(s), Director, Technical Director and representatives of the funding body.

Getting Started

Once you've been appointed, get hold of a script and familiarize yourself with the play. Chat to the Director about what they want - armed with their ideas, you will know what you need in the way of licences, equipment, personnel and sound effects.

Be aware that the evolving nature of rehearsals means the Director will frequently change their demands, adding new sound effects, altering the position of a microphone etc. Try to get as much out of them as you can initially, then maintain frequent contact in order to avoid – as far as possible – having anything sprung on you at the last minute. Try to be patient and remember, they aren't trying to be awkward, they just want the show to be as good as possible.

Early Priorities

The Producer will be allocating the **budget** to various different areas of the production. Sound usually demands a comparatively low of finance, and it may be forgotten, so make sure your producers hasn't forgotten you. Sound for playback shows may cost nothing or might need about a tenner to cover buying / hiring effects, whereas musicals might need £200 or more (see 4) Hiring Equipment).

Always agree a budget before you spend anything then if you think you will need more, or significantly less, renegotiate with the Producer. Beware: Any money you spend over what is agreed might not be repaid by the production company.

The Producer will probably be in communication with the Theatre Management about **licences** for candles, smoking etc, but if you need any firing guns, make sure they have started the ball rolling on this as it can take several weeks to get licences arranged.

Although the standard equipment in the ADC Theatre (and most other venues) is available for free to shows using that venue, it can also be hired out to other productions. If you are working in a venue which owns the equipment, such as the ADC Theatre, you will have first refusal of the equipment, but you need to let the management know what you need so that they know not to book it out. The standard front of house speakers, playback equipment and desk will only very rarely leave the ADC, but if you want microphones, additional speakers, or significant amounts of cable etc, have a chat to the Technical Housekeeper in advance of the show. He will also be able to advise you on the best equipment to use if you're unsure.

If your venue doesn't have all the equipment you require (or indeed any at all!), then you will need to arrange to **hire equipment** from another source. Good places to start are the ADC Theatre itself, and Stage Electrics. [[Click here for more details about Stage Electrics and other technical suppliers](#)].

One thing to bear in mind is that even shows performing at the ADC Theatre need to pay to hire the theatre's six Radio Mics. This is because of their costly and delicate nature. In general, Mainshows pay £6 per performance per mic, Lateshows pay £5 per performance per mic.

Remember, don't spend anything unless it is within a budget agreed by the Producer.

Before The Get-In

In order to be most efficient during the get-in weekend and run up to the opening night, you need to be well prepared before it begins.

Try to attend at least one **rehearsal**, preferably a run through. If you are Sound Designing a musical, it is absolutely crucial that you have seen the cast and band together in action, know the songs and who sings what when. It can be a good idea to get hold of the CD of the musical so that you know that songs, but be aware that this is no substitute for attending rehearsals and can, debatably, be to your detriment, as the recording will be slightly different from your version.

Figure out whether you need any **additional** personnel on the sound team. This may be because you cannot operate the show every night, or more likely you require someone onstage during each performance to operate equipment or swap radio mics between cast members. If you do need anyone, make sure you've sorted them out in advance so that you don't have to worry about it on the night – it needn't be the same person every night, but each one will need you to go through their role with them, so its advisable not to have too many different assistants.

To get hold of people, you could just ask friends to help, but if you need to advertise, send an email out via the Techies List [[click here to send an email](#)] detailing what you need people for and when, and making it sound like an attractive opportunity.

If the show involves personal microphones, you will probably find that it is advisable (if not necessary) to hire fewer microphones than you have leads and then swap them between cast members during the show. In order to do this you need to create a **Mic Plot**. This is a map of where each mic is at any time during the show and when it gets changed.

You need to know which microphone each singer will have at any time and your runner needs to know when, where and who to get each one off / give them to. If you can, give the lead a microphone of their own and just swap the others about. Also try to put similar types of singers on the same one (e.g. don't mix men and women, or sopranos and tenors). Changes need to occur when the relevant actor is offstage and has time, so don't try to combine them with a quick costume change or run-around. For really fast changes you might have give each person a microphone and just change the pack (the bulky bit that does the transmitting)

Part of a microphone plot might look like this one:

	'Turning'	'Empty Chairs'	'Wedding'	'Beggars'	'Finale'
Mic 1	Valjean				
Mic 2	[off J to M PS]	Marius	[pack off M to T OP]	Thenardier	
Mic 3	Woman 1	[off W1 OP to C PS before 'dead and gone']			Cosette

Leave yourself enough time to find the Sound Effects and Music tracks you need for the show. For recorded music, borrow it from friends or cast members. If this fails, hire it from the local library; alternatively HMV in the Lion Yard will sometimes lend you a CD for a few days in exchange for a

mention in the programme (check with the Producer / Programme Designer before promising this). Beware of copyright in music – all music is the intellectual property of the person who first composed it, and you need their permission to use it in a show. To this end, the Performing Rights Society collects royalties on behalf of its members in return for allowing you to play their members' music, and most of the music you will want to play in a theatre will therefore require a PRS licence. The ADC Theatre has its own PRS licence and charges a proportion of the cost to the shows that use pre-recorded music. Examples of non-PRS music include radio station jingles, things composed for specific event or companies or adverts or some television theme tunes etc.

The possibilities are endless for the sound effects your director will ask for! The first place to look is the ADC Theatre's library of effects CDs, which have everything from pre-recorded thunder storms to people sounds, with aliens, horror sounds, screams and farm animals just a few of the other categories available. Beware, some of the recordings are very old, poor quality mono. The local library also has few sound effects CDs. You can also purchase sound effects from the internet. They cost anything from £1.50 upwards, so this can be an expensive way of doing things, but its worth bearing in mind. [[click here for a list of useful links](#)]

If you've the time and the technology, you can always create your own effects. Sometimes this may mean recording the actual event with a borrowed portable MiniDisc recorder, for example to record voice-overs. If you are doing this, try and record them somewhere where there isn't any background noise and somewhere with a dead or at least not unpleasant acoustic or echo. There's nothing worse than a voiceover being used in a show with lots of background hiss, someone shouting in the distance or the subject of the voiceover sounding like they're in a bathroom (unless that's the effect you're looking to create!)

Remember, also, that creating your own effects can be much less sophisticated than this. A comedy punch was once engineered by someone punching a cabbage near an off-stage microphone; the most realistic footsteps are created by cast / crew walking about backstage, for gun shots try to use blank firing guns (see Early Priorities: Licences above) and there's a thunder sheet above the SMs desk at the ADC Theatre.

Once you've found them, you should coordinate your effects and music for easy use and identification during the show. Generally, the pre- and poststate music will be one or two CDs, so you can just play them in the CD players, but you are advised to put effects on one or two Minidisks rather than swapping effects CDs during the show. The obvious advantages are that you will then just have a single disk to deal with, and you can record the tracks in the order you want them. With minidisks, you can also label the tracks and cut silence off the beginning. Bear in mind that you can time them most accurately if the sound begins immediately you press play. Minidisk players work with minutes, seconds and frames (70 per second) so you can crop effects very accurately.

When combining your effects onto minidisks, don't forget that if you need to 'cross-fade' (fade down one track whilst fading up another) two effects, the easiest way (equipment permitting) is to use two disks in separate players.

If it will be your first show at the venue, acquaint yourself with the equipment. Sometimes you may only be able to do this during the get-in weekend, but often you will be able to arrange access to the box or operating station in the week beforehand. This gives you an opportunity to investigate the devices you'll be using, find out how to operate the desk (the manual will usually be stored near it, ask the venue management if you cannot locate it) and experiment with Graphic Equaliser / Digital Effects units.

To keep the paper tech (below) efficient, try to get together with the Director beforehand and go through your cues with them to get some more information. If possible also get them to listen to the effects you've found to check they are happy with them. Find out:

Volume: a description, not a figure, so things like 'barely audible' or 'deafening' rather than '10 decibels'.

Direction: do they want it coming out of the Front of House speakers? From a speaker on stage?
Stage left / right?

Fades: Does the effect start or stop suddenly, or does it fade? If so, is it a quick fade or a slow one.

Sometime around a week before the beginning of the run, the Stage Manager will organize a 'paper tech'. This is where the Director, Lighting Designer, Sound Designer and Stage Manager get together to sort out exactly where in the script each cue comes. During the show, you will be taking your cues from the Stage Manager (see Running the Show), so it's vital that (s)he knows exactly where they come. You will probably find that the Lighting Designer has many more cues than you do, but it's easiest for the Stage Manager and Director to have you both there at once, so be patient.

The Get-In

During the get-in, you will probably find that you are much less busy than the Lighting Designer and Technical Director, so you may be asked to help out. Remember that you're working as a team to make the show the best you can all round, but also remember that your first priority is to get all sound equipment ready on time.

Set up any extra speakers you need. These may be used to add directional effects, but you may also need to use them for foldback. Everyone will have an idea of what foldback they want and it varies hugely by individual and show, but put generally, the Musical Director will want to hear a full mix, band members want to hear themselves, the keyboards and a bit of vocals, and the cast want the main tune – often keyboards and/or guitars. Bose 820s can be used for all speaker purposes, unless you have a very large budget, in which case you could try to hire a specialised speaker system for this and / or the Front of House mix.

If you are using working equipment onstage (e.g. a hi-fi or radio), make sure it has been tested by the management then set it up. Also make sure the cast member who will be operating it knows how to do so.

Set up any personal microphone stands and cable up ready. Don't leave microphones lying about though, they are highly stealable and also risk being damaged.

If you have a band, set up their area as much as possible. You will already have agreed where they will be with the Musical Director and Director, it is most likely to be either onstage, in the pit, or in the Green Room. Wherever they are, you will need to set up chairs, music stands, microphones and speakers. Mics can be put on stands, but if you're short of space you can also invent ingenious ways of hanging them from above the musicians. Speakers are needed for foldback (so that the musicians can hear themselves) and you might want to use several different mixes for different parts of the band. Finally, don't forget the instruments themselves. In most cases this is just a question of leaving people enough room to play comfortably, but you will probably be helping them to move in keyboards, guitar amps and drum kits. Also bear in mind that the band need to be able to get out quickly in the event of fire.

For musicals, the cast ideally need to be able to see the Musical Director. This may mean using the 'Panto pit', whereby the band are in the Pit, being conducted by the MD. However, one of the end pieces of the forestage is removed so that the MD can see through the gap and be seen by the cast. You will need to clear this with the Technical Director and Director early – that piece of stage and the Juliet entrance may be used in the play. Alternatively, if the MD cannot be seen directly, you can string up a video feed – a shot of the MD is piped straight to monitors which can be placed in the Perches or else hung from the bar at the rear of the auditorium. Video patching is located in the amp rack.

Sound checking is only really needed for musicals (including the Panto). Make sure the Technical Director has allowed you time during the get-in period to run one. Spend a bit of time getting the band to practice and setting the microphone levels so that you are happy with the mix. Obviously

levels can and will be changed during the performances, but knowing the basic position is useful so that even the first note of the Overture sounds good. Be wary of guitarists, who will want to turn their amps up. Explain to them that you will be making the mix sound good from the auditorium, so it's important that they don't change their settings. This is also the time to sort out what levels of foldback everyone wants and to make sure they're happy with it.

During the Sound Check is also the time to take preventative steps against feedback. Feedback is when a nasty tone comes out of the speakers. This can occur simply by increasing the volume too far on a playback track, in which case you should not push the volume so much. However, the most common cause of feedback is the creation of a loop. Basically, this is where a microphone picks up the sound coming from a speaker and tries to send it through the system and back to the speaker. There are several things you can do to minimize the chances of this occurring:

- Try not to point speakers towards microphones (bear in mind the broad angle of the 802s). this means that when you're setting up foldback speakers at the ADC Theatre, it's best to set them behind the iron pointing upstage, as most mic-work often happens on the forestage. Similarly with the band angle them carefully.
- Warn the cast and Director that standing too near any speaker while using a microphone is a bad plan – if they want to use the sides of the stage, they may be able to do so a few steps back from the edge.
- You can prevent feedback by minimizing the sound levels coming out of the offending speaker – i.e. turning down either the volume or the gain (red top at the top of each channel on the desk). However, this obviously makes it quieter for the audience, so may not be possible.
- Having done all this, you can further minimize the risk by 'notching out' feedback frequencies using the Graphic Equaliser (EQ). To do this, send the signal through the EQ, and ask the singer to rehearse a song. While they are singing, gradually push up the volume until the speakers begin to feedback. At this point, try pulling down individual sliders on the EQ machine until the feedback stops (if moving a slider has no effect, return it to the standard position). With practice you will be able to identify the offending frequency with greater ease, but don't worry that it takes a while to find it to begin with. Once the feedback stops, increase the volume again until a different frequency begins to feedback and repeat the process. Eventually you will find that the sound feeds back on several frequencies at once, at which point you should stop.

The Tech

During the Tech, you should make sure that you have practiced, and are happy with, every one of your cues for the show. For each playback cue, you need to know exact details on volume, timing, fade times, direction and, don't forget, when and how it stops as well. You should also run through each song in full for practice and in case the Director has any special requests about volume etc for these. You should also go over any quick microphone changes in real time to ensure that they are possible. If you are not happy with something, or want more information, don't be afraid to get the Stage Manager to stop the Tech to give you a chance to go over it and re-run the cue. When there is only a small amount of sound in the show it can easily feel like the Tech is being dominated by Lighting, but the time is just as much yours when you have a cue! The Tech is also the time to label everything and make notes, so that another Sound Designer could operate the show in your absence. It's most vital if you have an operator running some of the performances, but you should assume there will be someone else, just in case. These notes will also mean that when you arrive before each night, you can quickly look over the desk, EQ and patch to make sure no-one has altered any of the settings. This check is especially important if there's another show in the same week as you – get hold of their Sound guys in advance and talk over the two shows' requirements as you may find you can get away without changing each others' settings at all.

- Write a list of any patching that you've done as it should begin the show (e.g. Microphone stand to socket J2 to channel 22).

- Run a strip of white LX tape horizontally along the desk and use a Sharpie marker to note which Channels, Auxes etc deal with which items.
- Draw yourself a rough map of the desk settings as they should be at the start of the show (all the knobs / 'pots' on the top half of each channel, dealing with Gain, Basic EQ, Auxes, Feed, Pan)
- Draw a map showing the settings of the Graphic Equaliser.

Write out a cue sheet. Again, this is designed to be read by others, not just yourself. During the shows, the Stage Manager will call the cues, so exact timing is not important, but all other details are, and it's good practice to keep with it a script marked up with cue numbers so that you can follow the play.

When numbering cues, you will come across a number of different conventions, so agree with your Stage Manager which you will be using. One obvious method is to use integers to represent new cues, and decimals to signify changes. e.g. Cue 1 starts the track, cue 1.5 stops it. This way you can easily add other changes without messing up your numbering.

One type of cue to look out for is the 'Visop' (Visual Operation) cue. An example of this might be turning on music when an actor presses play on a prop tape deck. Again, check with your Stage Manager how they run these cues, but they will probably give the operator a Standby, the actual 'Go' is taken visually.

Most of the time, a sound will go through two faders on the desk – that related to the individual channel, and the one for the Mix or speaker in question. If possible, keep the speaker volume constant and use the individual channel fader to alter the volume. If you manage this, you can just write the Mix level once at the start of the cue sheet. Sometimes this will not be possible (to get something very loud or very quiet you may need to change it), in which case you can indicate the two levels with a slash in between. E.g. -20 / -5 (where -20 is the channel level, -5 is the mix level).

Part of a good cue sheet might look like this, assuming the Mix volume is at -5 as standard:

Cue no	Page	Track name	Track / Device	Volume /Fade	Notes
5	15	Footsteps	Tr 1 / MD1	-20 slow in	PS speaker only
5.5	15			Slow out	Pan back to centre
6	20	Agadoo	Tr 3 / MD1	-10 Fast in	
6.2	21			Fast up to 10/10	Feedback is good!
6.5* Visop	21			Cut out	*As Harry presses stop Mix back to -5

And Finally...

Everything pre-show is the hard bit, once you've actually got it all set up, you just have to worry about making it sound fabulous on the night! Mixing is, arguably, the most fun bit of Sound Designing and while it can at times be a bit hectic is a really thrill to get it sounding great.

After that, the Get-out should be easy, just take out anything you put in, and put it away. You will again be expected to help others if you finish first, but then its time for the party.

Good Luck and Have Fun!