Proceedings of The Institute of Acoustics

"ELECTRO-ACOUSTIC SYSTEMS - A REVIEW OF THEIR USES, ABUSES AND IMPLEMENTATION"

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The last few years has seen considerable growth in the number of Sound Reinforcement and Electro-Acoustic system installations in this country - ranging from the simple Sound Reinforcement or P.A. system to be found in small halls, churches, etc., to the complex systems required in today's modern multi-purpose halls, conference centres and theatres. Other speakers at this Conference will be talking about such systems in considerable depth, but by way of introduction to the session I would like to present a few past experiences and open up a number of areas for discussion.

The size, complexity and success of recent sound systems would appear to vary considerably - there would appear to be a number of reasons for this latter characteristic - but essentially they seem to stem from the fact that all too often either the clients, architects or services engineers do not understand the basics of Sound System design and use and the way the system must interface with the room or space in which it is to operate. This gives rise to two distinct groups, those who seem to believe that almost any Sound System must by necessity produce a quality of sound more akin to that experienced on railway platforms or in supermarkets (i.e. systems have always sounded like that and the public accepts it and therefore why should they pay for anything better), and those perhaps enlightened by hearing sound reproduction of reasonable quality through their hi-fi or television etc., who expect a sound system to be able to produce similar quality but also appear to expect it to overcome the basic laws of physics, acoustics and economics! For example, such a system would typically be required to provide coverage to all parts of the space using invisible loudspeakers (of small dimension!) and operate in an acoustically hostile environment (i.e. with a proliferation of reflecting surfaces arranged such as to positively encourage sound focussing and the generation of strong echoes and excitation of the reverberant field). The system will also, of course, have to meet its allowance provided in the overall budget, which is generally around a third of that actually required!

There is also a third group of architects, interior designers and services engineers that seem to believe it is possible to overcome almost any acoustic problem using an Electro-Acoustic or Sound Reinforcement system.

Unless the Electro-Acoustics Consultant has a strong sense of conviction and stubbornness concerning loudspeaker positioning and acoustic treatments of surfaces, many a system will be doomed from the beginning. Architects, clients and internal designers, etc. must be persuaded that the sound system is very much a part of a space and that to function correctly it needs to be designed into the space, requiring just as much attention as the lighting for example.

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Although all sound systems essentially comprise of a microphone - amplifier and loudspeaker -, the block diagram of a modern system is rather more complex than this, employing further gain, filter and routeing stages as well as a number of signal processing stages such as equalisation, delay, compression/limiting, phase shifting, noise reduction/gating, etc. Each stage, although allowing greater control over the final sound quality and total acoustic gain available, also of course adds to the final system complexity and cost. A large number of systems do, however, still appear to be being installed without sufficient control or processing facilities - the addition of just an equaliser to a system can generally produce a significant improvement in terms of clarity, intelligibility and gain achievable before feedback.

However, even when a system has been well designed and installed, there is still no guarantee that it will be successful - to fulfill this requirement, the system must be suited not only to what the client said it was going to be used for but also to what it will actually be used for (e.g. rarely is a speech system used purely for speech, although intended and designed for this practice many systems in the author's experience end up being used to reproduce music or reinforce music or vocals - requirements well beyond the capabilities of the majority of speech systems).

The success of a system also very much depends on its ease of use and its ability to withstand misuse and operation by either poorly trained or even non-technical personnel. This latter class of user is rapidly growing as more and more Commercial and Industrial Organisations refurbish and re-equip their lecture theatres and conference rooms and as more Leisure Centres are built and their range of activities extended. Some of the problems associated with non-technical operators can be overcome by simplifying the control provided - though not necessarily the system's sophistication. Indeed, by making the system rather more sophisticated (from an electronic point of view), the less the operator has to do - even employing pre-settable (and lockable) controls - can often, in the author's experience, improve system operation considerably.

Whereas such an approach may be feasible for relatively simple systems, this approach is often not suitable for larger conference and multi-purpose use. In such circumstances, although a permanent technician is generally available, unless reasonably competent and fully conversant with the system's design and concept, even the best of systems can be reduced to total unintelligibility. However, recent advances in micro-processor control and signal processing technology will, before long, mean that further reductions on the demands on an operator can be made. Already automatic equalisation and computer controlled routeing facilities are available, whereas a completely automated system diagnostic check and alignment procedure would also be quite feasible - again further reducing the demands on the operator, though at a price.