

A multi-purpose Sound System

DAVID COLLISON

The O'Keefe Centre for the Performing Arts in Toronto, is undoubtedly one of the major theatres in Canada. Not only is it the home of the Canadian Opera Company and the National Ballet of Canada who both perform seasons there every year, but it is an important venue for tours of musicals and plays and for international entertainers of the calibre of Harry Belafonte, Liza Minelli, Liberace, Tom Jones etc.

Ever since the theatre opened in 1960 it has been dogged by an audibility problem which is due to the sheer size of the auditorium coupled with some inherent acoustic deficiencies.

The original sound system appears to have been totally inadequate and an update of the loudspeaker installation in 1970 obviously did not provide the answer.

I was approached in 1976 to make an appraisal and add my findings to the already thick file of reports which the management of the O'Keefe had commissioned during the previous eight to ten years from various eminent acousticians and sound designers from Canada and the States.

Mission Impossible

When I first walked into the 3,212 seater auditorium the words 'Mission Impossible' flashed on to my mental screen and I wondered why I had left behind the cosy little West End theatres like the Palace and the Theatre Royal, Drury Lane.

To give some idea of the size, if you take a line from the centre of the front edge of the stage on the diagonal to the farthest seat at the rear corner of the balcony the distance is approximately 155 feet (47 metres). Whereas if you take the same measurement in the National Theatre's Lyttleton auditorium the distance is somewhere around 62 feet (19 metres).

Furthermore, being a fan shaped auditorium and with a balcony holding roughly one third of the audience, well over two thirds of the seats are in the rear half of the house - sixty feet from the stage and beyond.

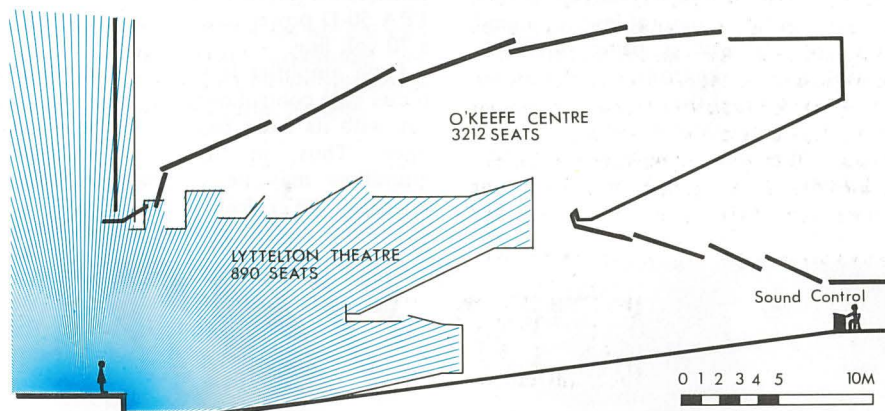
The proscenium opening is 60ft wide by 30ft high and the stage area is 125ft wide (including scene dock) by 56ft. Stage floor to grid is 85ft.

Taking all these factors into account it was obvious that most performers finding themselves facing such a large auditorium on one of Canada's largest stages would be thankful for a very efficient Sound Reinforcement system.

I decided from the outset that the requirements for Sound Reinforcement and for the singer/entertainer (or 'Vegas Act' as it is often called) were entirely different. For the reinforcement of a play, musical or

even opera (would you believe?) an extremely even coverage of 'uncoloured' sound is vital together with loudspeakers providing a very good feedback rejection. Whereas, for the close microphone technique employed by recording artistes feedback is not such a problem but it is necessary to provide a big full frequency range sound with plenty of bass to cope with the amplification of musical instruments.

The existing loudspeaker system consisted of a central array of bass bins and multicellular mid/high frequency horns suspended above the orchestra pit. This arrangement is favoured by many American and Canadian sound designers because a



complete coverage of the auditorium is possible from a point source thereby minimizing conflicting sound paths which can create unwanted reflections, standing waves and phase cancellations.

But although it is certainly possible to obtain a very even distribution of sound from a central array it has always been my contention that *theatrically* it does not work. I have also had a theory that for successful Reinforcement part of the secret is to have the loudspeakers positioned as low as possible (and therefore necessarily at the sides) so as to be in the same height relationship to the audience as the original sound source - the performer. This not only assists the illusion of the sound coming from the stage but it automatically takes advantage of any natural acoustic gain from reflections off ceilings which have been designed for that purpose.

But an overhead array, particularly with such a wide proscenium opening, is vital for filling in that first centre wedge of the auditorium and for focusing the apparent source of the sound into the stage.

Four loudspeaker systems

So the final scheme as presented and accepted by the management of the O'Keefe Centre called for four separate loudspeaker systems which, in various combinations, would cope with the different requirements. They were as follows:-

1. Central Array

The original overhead central position above the proscenium was retained, but a large section of the ceiling panel and superstructure was cut away in order to make possible a direct shot to every seat in the house. The only loudspeakers utilized from

the old system were two ALTEC bass bins each with two 15" bass drivers which date back to the original 1960 system. These are supplemented with two JBL bass bins with single 15" drivers, and six JBL radial horns for the mid frequencies associated with six JBL pressure units for the highs. The horns, mounted above each other in an arc for minimum phase cancellation, are utilized as follows: one pair cover the balcony (the required vertical distribution of only about twenty degrees is obtained by bolting the two horns together which effectively increases the energy by 6 dB within the 20 degrees), a similarly arranged pair covers the rear stalls under the balcony, and two single horns cater for the mid and front stalls where progressively less sound pressure level is required. The front horn may be muted from the control console if the front block of seats is removed for an extended forestage or for an orchestra pit.

2. Stereo Music System

The second loudspeaker system comprises JBL bass bins and horns mounted in