THE QUIET REVOLUTION

Computer technology is making inroads into the control of sets, scenery and lighting rigs. The technology introduced so far has largely gone unheralded. Jim Douglas takes a look at progress to date

It is always revealing to receive comments from an 'outsider' about the entertainment industry in which one is working. I invited an acquaintance into a theatre recently to view the 'goings on' during technical rehearsals. After he had picked himself off the floor, having stumbled in the dark over a badly parked Tallescope, his subsequent reaction was to the sheer number of VDU screens spread around the stalls.

As someone who has worked with computers constantly for the last ten years or so I just took all this technology for granted. But there they were, all those screens, softly fluorescing, and giving some little clue as to the amazing amount of computing power that we have harnessed for our benefit over a relatively short period of time.

On this show, as with most these days, the lighting department took the prize for the most monitors perched on a single production desk. The lighting designer had a clutch of monitors at his elbow to show him what the lighting board and PALs were up to, plus his own computer on which were CAD plots of the lighting rig, schedules etc. The PALs were also being operated from the auditorium.

The sound department had VDUs associated with the configuration of the desk and the performance of radio mics along with PCs being used for CAD planning and recording of the installation in the theatre. Even the script was being updated in real-time on a word processor as the inevitable changes were being made . . .

And, last but not least, the reason I was there, the computer control system responsible for co-ordinating the movement of a major part of the set. Yes, personal computers and micro-processors have arrived in this area of the entertainment industry, and as far as I can make out, are here to stay. Techniques and technology developed in the field of industrial robotics and motion control are now readily available to the entertainment industry. Their application to staging and sets opens up a complete new range of possibilities. I sense interesting and exciting times ahead!

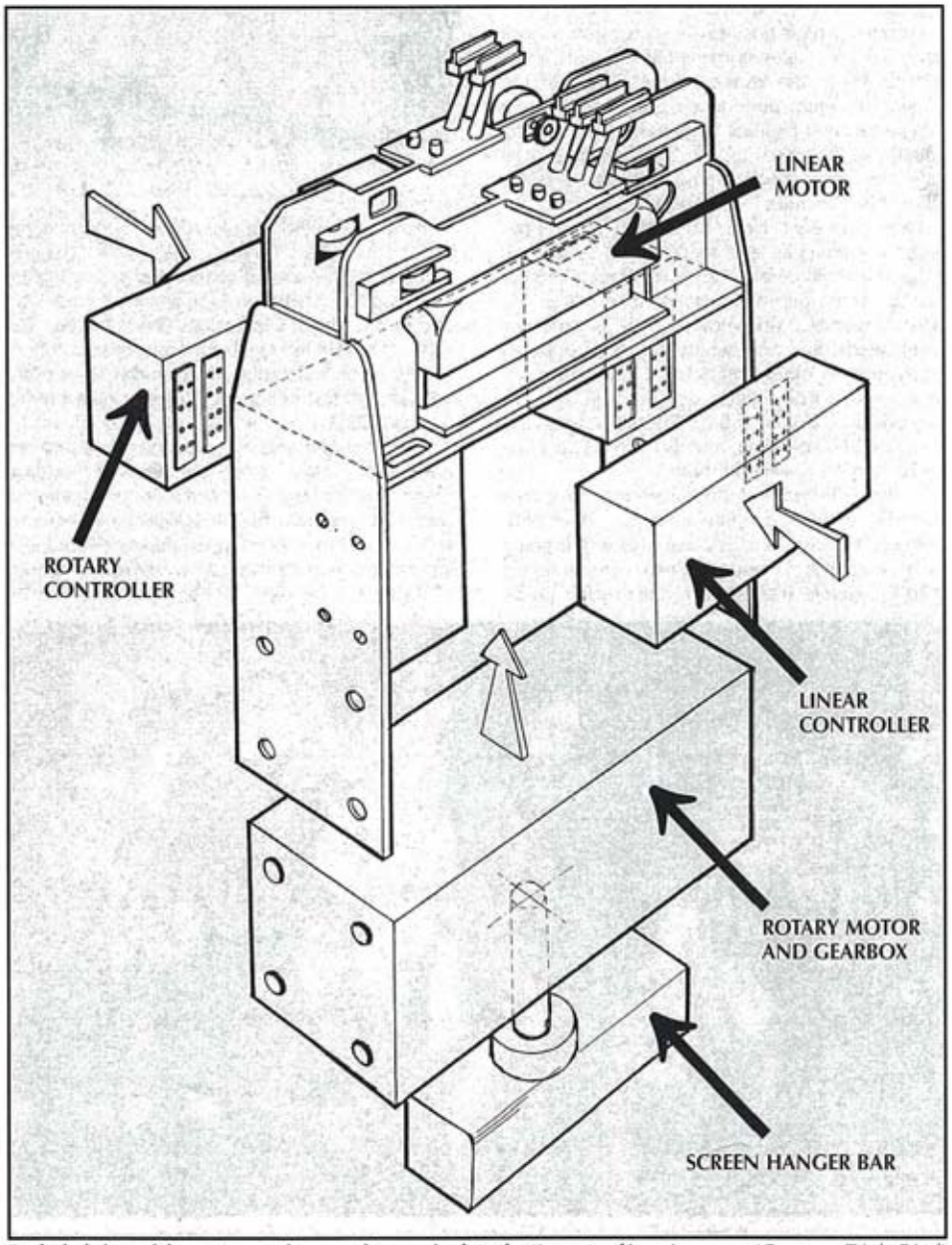
Some while ago John Offord was at great pains to welcome to the Professional Lighting and Sound Association companies whose business revolved around neither lighting nor sound, but were more concerned with staging and sets. I will take this a step further and announce formally the birth of a new area of theatrical technology dealing with the manipulation, control and co-ordination of sets, scenery, lighting rigs etc under computer control, henceforth to be known as Theatrical Automation. Furthermore, (said he, with tongue firmly in cheek) PLASA and Lighting+Sound International will have to consider a change of identity to reflect the emergence of this important branch of the industry. I also demand that technical reviews of shows should deal with the automation aspects in more than half a column inch buried amongst endless lists of lighting equipment. Seriously though, I suggest that a byline on the front of L+SI to the effect that the magazine deals with all technical/technological aspects of the performing arts might serve to widen its appeal somewhat.

My own involvement with Theatrical Automation has arisen as a natural progression out of working on the technical side of sound and lighting equipment and with micro-processors and computers. Conscious of the fact that I seemed to be somewhat close to the sharp edge of this technology, I decided to make contact with other people in the industry who were working in this, as yet, embryonic field to try and ascertain the progress to date. The results of my investigations were interesting and enlightening and if I have interpreted them correctly give some pointers as to the way forward.

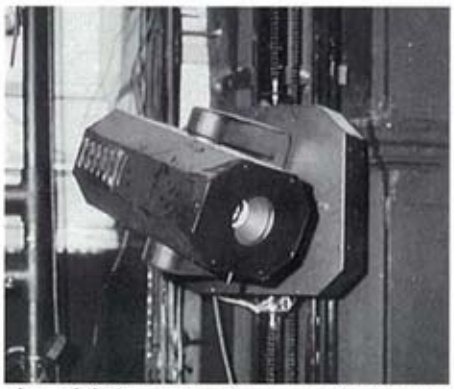
Sets in theatres have been mechanised since the year dot. You only have to take a trip around the understage areas of the Theatre Royal Drury Lane to see examples of stage machinery from years gone by. The application of hydraulics and electric motors to move scenery has kept pace with the improvements in the available equipment, but to my surprise, almost always under the direct manual control of an operator. It is only in the last few years that computers have been occasionally drafted in to help out in this area. In theory, the marriage of modern day electro-mechanical and hydraulic capability to the 'intelligence' of the computer should provide the quantum leap, as Francis Reid put it (L+SI Oct 90), from the 'art of the possible' to the 'art of the desirable'. A little reflection on what has been achieved (and also not achieved) so far, may help in avoiding a transition from the 'art of the near-impossible' to the 'art of the totally absurd' where science intrudes on art and attempts to become a spectacle in its own right.

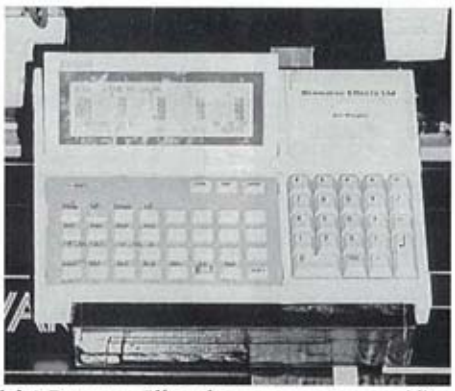
The introduction of computers into this area of theatre affects a number of disciplines, so the subject needs to be explored from differing perspectives. The systems engineers and suppliers can say what is currently possible. How does this match up with the set designers and directors expectations? How do stage hands feel about their job being performed by an electric or hydraulic motor? What do operators want the computer to do, and how much do they wish to be left to do themselves? On top of this add the questions of cost-effectiveness and safety. I don't claim to be able to answer all these questions, but at least I can start the ball rolling and perhaps provoke a few readers' and other contributors' grey matter into action.

Two people who were able to give me a



Exploded view of the motor carriage used to manipulate the 'Aspects of Love' screens. (Courtesy Triple E Ltd)





Above (left) is a Vari-Lite in use on Miss Saigon with (right) Dramatec Effects laptop computer providing control.

good deal of information as to how things have developed over the last few years are Mike Barnet and Mikki Jablkowska. They have worked together on many productions recently. Mike is well-known and respected throughout the industry for his ingenious design of mechanised moving scenery. Mikki has spent her time as a scenery operator on a number of shows — usually designed by Mike — and at present, nightly 'drives' the set of Miss Saigon. Another person I spoke to who was able to give me the 'customer's' point of view was Richard Bullimore. Richard was a production manager for the National Theatre and numerous West End shows. I was unable to make contact with any set designer during my researches for this article. If any designer would like to make their views public on this subject, I will willingly use it as the basis of a future article.

On her lofty operating perch overlooking the stage of Drury Lane Theatre, Mikki voiced her major concern that the first potential victim of the computer age is the operator suffering 'brain death'. The boredom — leading to loss of concentration and mistakes — that comes with the repetition of operating the same show every night can be avoided only if the task is made interesting and demanding. If everything is controlled by the computer with the operator relegated to mechanically pushing the button in response to the cue light, then enthusiasm for the job will evaporate rapidly following the opening night. On the other hand, a complex set with multiple simultaneous moves involving many motors may be impossible to control even with a large team of highly competent operators.

Mike Barnet's objectives for a computer system are to achieve elegance and precision. He agrees with Mikki that a busy operator is a good operator and urges them to 'use eyes first and instruments second.' But any computer system should have a good manual back-up and the operator must continually rehearse the show without the use of the computer.

I don't believe that there are any definite simple answers, as each problem has to be judged on its merits, but there are some guidelines we can follow. These derive from consideration of what it is that computers are best at, versus the abilities of us poor humans.

Co-ordination

The computer is able to scan and react to many more simultaneous events than we can cope with. When the requirement is for simultaneity of events or the precise alignment of scenery the computer wins every time. The computer is also able to look ahead by means of extrapolation.

Timing

In the context of live performance the computer has a poor sense of timing. Events programmed into a computer will usually occur at fixed, pre-determined intervals. Operators ideally need a means of intervention to adjust the rate at which events unfold, not just to cope with nightly variations or mishaps but from the more severe changes in timing brought about by changes in the cast or musical directors.

Measurement

The sensors available for the measurement of position are significantly more accurate than our eyeballs, especially if we are operating 20 feet away from the item being moved (usually in a blackout!). In this instance we can choose either to feed the positional information derived from the sensors directly to the computer or to the operator for action. It is in the latter case where the presentation of information to the operator as a rapidly changing set of numbers has often been difficult to interpret. The computer screen affords us with opportunities to present positional information and guidance to the operator in a much more meaningful form.

Communication

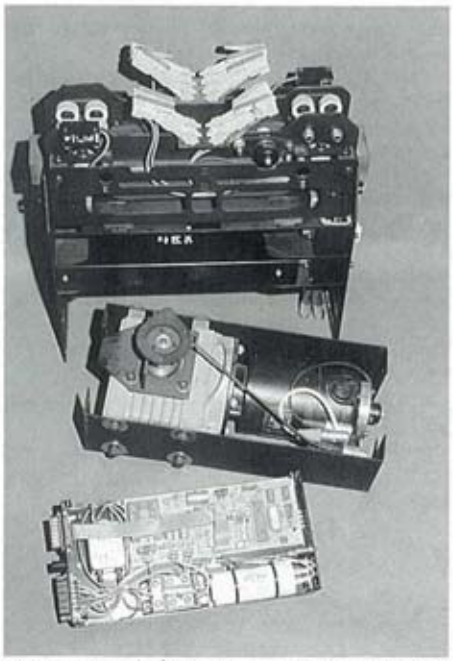
One of the biggest problems to be overcome is how to communicate our wishes and ideas to the computer — the conventional screen and keyboard being a somewhat restricting and inefficient interface. Computers, once instructed as to what to do, will faultlessly follow those instructions. One way of 'teaching' them what to do is by example. If a particular effect can be operated manually then let the computer capture the manual operation for subsequent repetition. Alternatively, man and machine have to meet halfway and communicate in some form of shorthand language.

Richard Bullimore made the point that however accurate and reliable a system is at performing its allotted task, all its potential for cost savings could be wiped out if it takes a long time to programme and re-programme it, especially come the technical rehearsal, when directors will demand instant changes at the drop of a hat.

Reliability and Safety

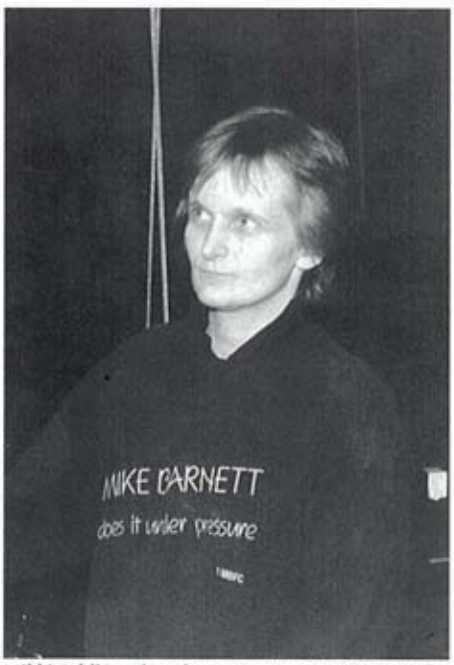
Today's computer equipment, if utilised correctly, is very reliable. Today's operator, if treated with respect, is also very reliable. But, on odd occasions both will malfunction. When considering a complete control system (including operator) there should be provision for self monitoring i.e. man should check the performance of machine and vice versa. There should even be provision for machine to check machine if possible so that errors can be self-diagnosed. It should be impossible for the operator unknowingly to put the equipment into an unsafe condition.

Things can go wrong outside the system. People and props can get mixed up with moving scenery, sometimes with disastrous results. If an actor is required to be transported by a piece of mechanised scenery then his life can quite literally be in the hands of the operator. We must learn quickly from the few accidents that

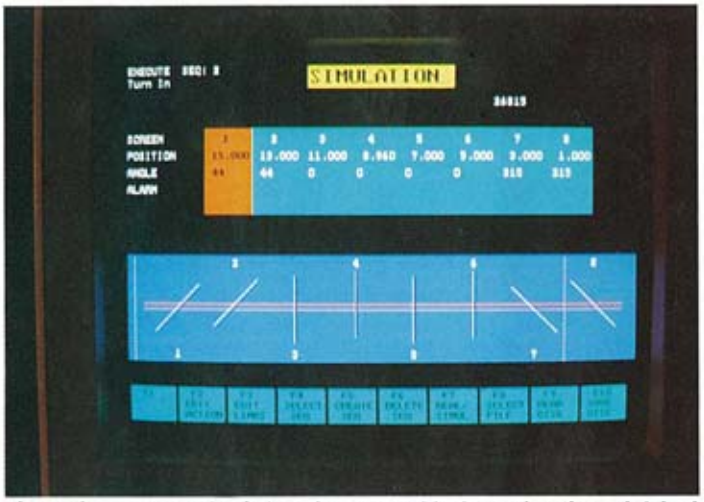


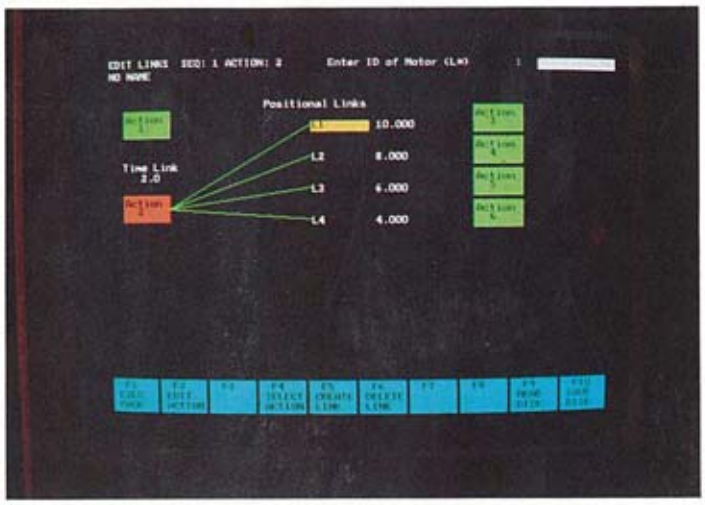
Motor carriage equipment used to manipulate screens.

Dramatec Effects' Jim Douglas.



Mikki Jablkowska, the scenery operator on Miss Saigon at Drury Lane Theatre.





Above, the computer simulation of screen positioning and angle, and right the edit link sequence.

have happened in order to avoid repetition.

A practical example of the solutions to some of these problems is the computer control system supplied by Dramatic Effects Ltd to Triple E Ltd for the London and New York productions of Aspects of Love. The brief was to provide co-ordinated control of eight (nine on Broadway) wooden slatted screens measuring approximately 2m x 6m and weighing 100kg. These screens were required to move from side to side of the stage and to spin about their vertical axes. It was decided early on that, in this case, the system would be extremely difficult to operate manually, so the emphasis was placed on providing a highly reliable automatic system with manual control for intervention in the event of a mishap.

Each screen has an associated linear and rotary motor driven by an intelligent microprocessor-based controller capable of positioning the screens to a high degree of accuracy. These controllers report the screen's position to, and receive commands from, a central computer responsible for overall timing and co-ordination. The problems of programming were solved by the devising of a 'language' to describe the screen movements. At the lowest level there is a 'move' by one screen only which can be grouped with other moves to form an 'action'. Actions can be linked by time or position to form a complete 'sequence' which is the event instigated by the operator on cue.

Programming is aided by the ability to run the system in graphical simulation to check that screens will not collide before trying a sequence 'for real'. The simulation also serves as a check on the positions of the screens while running and any major discrepancy between the reported position and the simulated position of a screen is signalled to the operator.

The system in London only has provision for manual control of one screen at a time. The manual control on the system for the Broadway production was for two screens (one for each hand), and overall the control was ergonomically better thanks to the input from Whiz, the London operator.

If we look across the Atlantic at our fellow bretheren on Broadway they appear to be further down the road of Theatrical Automation than we here in the UK. Some insight as to why we seem to be lagging behind arose out of my talking to Richard Bullimore. He considered that there was an opportunity to progress the state of the art with the production of 'Chess'. The original design required many trucks to come on and off stage to precise deads, and it was obvious that the designer's ideas were guided by what he had already used in the USA. The technology to achieve the required effect did not, at that time, exist in this country, but there was enough leeway in the production budget to fund its development. It is fairly common knowledge now that things did not work out as planned and that in the end the operation of the 'chessboard' was performed manually, as opposed to by computer as originally hoped. In Richard's opinion, the failure of this venture contributed to a lack of faith and confidence in computerisation that has set the UK end of the industry back a number of years. He would now (quite sensibly, I think) only look at backing a project which represented a much smaller increment in development based on what anyone had achieved to date.

Mike Barnett's opinion of the American approach to automation is somewhat mixed. While they may be further down the road, they may also be occasionally suffering from their national characteristic of being prone to excess. The American productions of 'Starlight Express' and 'Phantom of the Opera' are controlled entirely by computer. The latter production requiring a special room the size of a lorry container to house the equipment which, one gathers, was built generally to military specifications. In contrast, the London production has one equipment rack of electronics and the show is handled comfortably by one operator who is kept busy and interested. Similarly, the bridge in 'Starlight' is successfully (and much more gracefully in Mike Barnet's opinion) manually operated in London by well motivated personnel. The total reliance on the computer in the USA has, to his knowledge, led to the complete failure of the bridge on at least two shows, due to malfunction.

On the other hand the control system that impressed Mike most was supplied to manipulate the 'Dragon' on the Siegfried and Roy spectacular in Las Vegas (L+SI, April 1990). It is possible to manipulate the beast manually using four operators, each with two joysticks. The team develops and rehearses the moves, and when everything is to the liking of all concerned, the computer is switched to record for a 'take'. The stored moves can then be repeated exactly, ad infinitum or edited to further refine the effect. However, the operational team continues to rehearse the moves, ready for the day on which the computer fails to co-operate!

Broadway has its own set of problems to be considered when mounting a show there and the decision to use automation on a production is affected mainly by the prevailing local conditions. In the West End the indications are that Theatrical Automation can achieve a reduction in the running costs of a show in return for slightly increased production costs — a situation which I gather is to be favoured by managements.

Let me reiterate that this article represents a personal viewpoint and in no way do I purport to the presentation of an 'in-depth' or 'balanced' survey of the subject. I hope my mention of past mistakes does not make anyone too uncomfortable. In engineering it is always vital, I believe, that we learn from those jobs that did not go quite according to plan. I am willing to admit that I am not completely blameless in this respect. On the basis of 'no gain without pain' I gave the production team a hard time on the London production of 'Aspects of Love' and I shall always be grateful for their patience and understanding. In this case the final outcome was successful and we were able to analyse the experience and learn from the mistakes such that the supply of the equipment for the Broadway production happened in (almost) copy-book fashion.

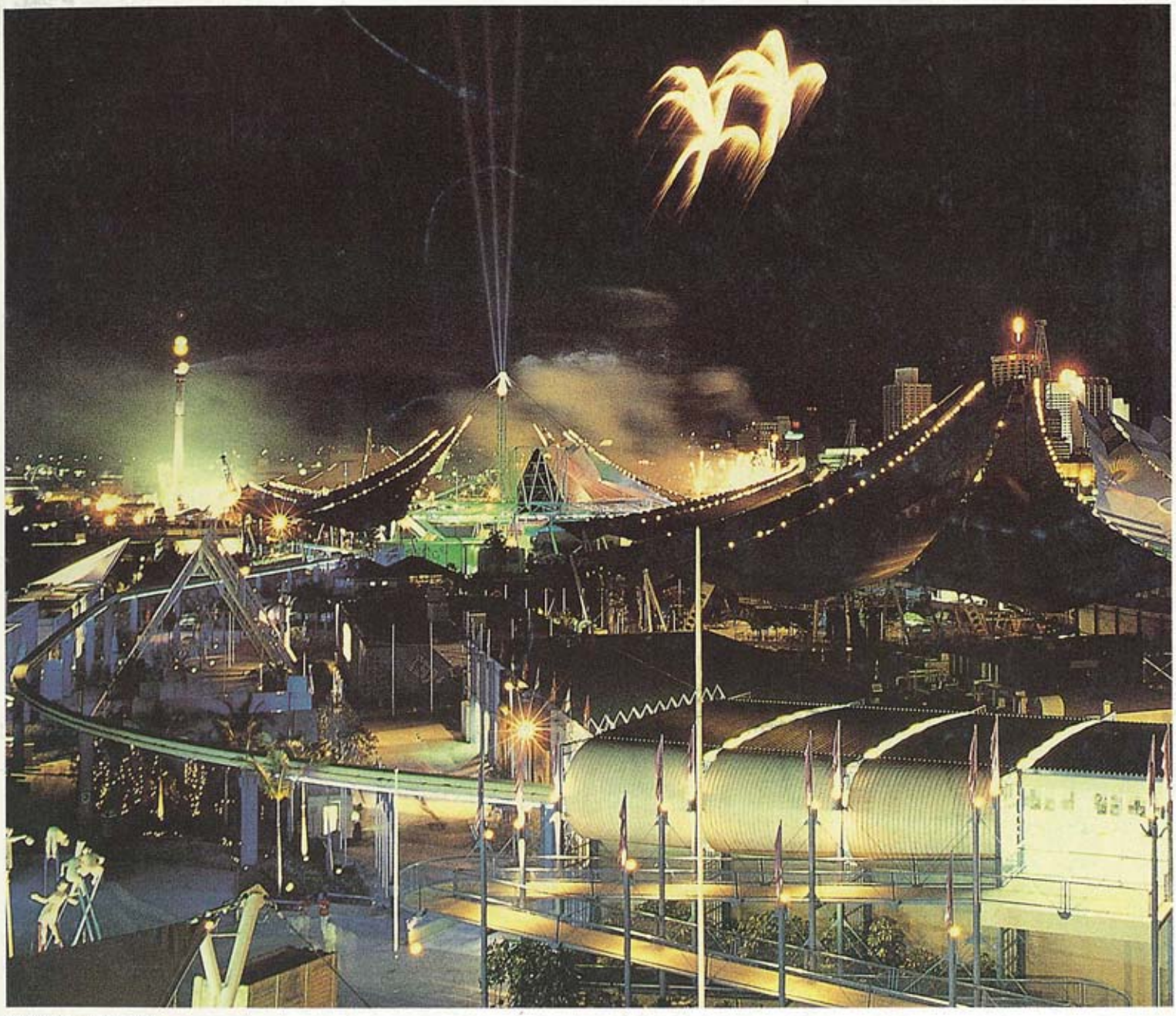
I perceive a challenging time ahead. The technology has now arrived to get a lot more motors 'quietly revolving' to the benefit of the entertainment industry as a whole. I look forward with anticipation to what the next few years will bring.

Jim Douglas began his career in theatre in charge of the sound department of Theatre Sound & Lighting Services, providing equipment and support for many West End shows. He moved to the National Theatre as chief sound engineer at the time of the transfer from the Old Vic to the South Bank in 1976. As a founding director of Green Ginger Ltd he went to work there full time in 1980 designing stage lighting control equipment. This was followed by a period with Polaron Controls Ltd designing architectural lighting control equipment. He eventually set up his own company Dramatec Effects Ltd in 1986 to provide a technical consultancy, design and build service to the entertainment industry.

Over the years he has been responsible for technical innovations. If you ever used NAB carts for sound effects, then you can blame Jim for their introduction to the theatre. He built an experimental, two preset manual sound desk with matrix routing and control grouping, was possibly one of the first people to design a microprocessor dimmer and is sure he is the first person to design a microprocessor-based precision position controller for the linear motor.

This Jim Douglas would like to point out that it is another Jim Douglas that works for Vari-Lite.

LIGHTING+SOUND International



EXPO NIGHT – SEVILLE 1992

- Jim Douglas and the Quiet Revolution
- Tony Gottelier and Society Talk
- Court Acoustics and Freudiana
- Company close-ups: Cerebrum, Lighting Dimensions (Eire) and Wilkes Iris Diaphragm
- Three-page PLASA Feature
- John Offord in Seville

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