H. MIRZWINSKI, B.Sc, (Eng), C. Eng, M.I.E.E

AUTOMATION OF BROADCASTING CENTRES

INTRODUCTION

Automation is not a new word in the dictionary of a broadcasting engineer. For years he has been using different automatic devices to make his work easier and more effective. Some of these devices, such as automatic gain controls, limiters, compressors and peak white clippers have become so familiar that they are not even considered as minor members of the automation family, that is circuits preprogrammed to perform certain functions without the intervention of a human operator. More sophisticated equipment, e.g, automatic radio or television continuity mixers, automatic cameras, telecines and video tape recorders, are gradually gaining a firmer foothold in broadcasting centres. But this is only the beginning. Using automation to solve isolated problems can bring only limited benefits. The ultimate advantage of automation will only be achieved if it is applied to a broadcasting centre as a whole, starting from business and administrative functions and ending with the control of technical functions.

An integrated concept of automation of the whole broadcasting centre is now becoming a viable proposition due to rapid developments in computer technology. Very powerful but economically priced minicomputers are now available and their physical size is small enough to make them quite inconspicuous among the broadcasting equipment in a television or radio apparatus room. Unfortunately, automation is still shrouded in the mystique of its jargon, its experts and consultants. It is often rejected outright by some broadcasters as merely a passing fashion or, at the other extreme, exaggerated claims are made for its potency as a universal cure for all problems. The truth is in the middle. Computer operation will not automatically solve all the problems. On the contrary, if introduced too rashly, just for its own sake, it can create more difficulties than it will solve. Automation is not purely a technological phenomenon; being a tool used by men to make their work easier and more efficient it encroaches also in the realm of sociology. Technical problems, given time and money, can always be solved, but in man-machine relationships a very careful balance must be preserved so that automation can serve man and not be his master. Many automation schemes have failed (and failures are not usually reported in technical magazines) because the necessary climate for a successful man-machine relationship was not prepared in advance. People whom automation will serve must fully understand its purpose and advantages and be willing to be served. Only then can they accept the stricter discipline that automation of necessity brings into their work and hence make the full use of the tool provided.

PURPOSE OF AUTOMATION

Broadcasting centres are usually very complex organizations that combine many disciplines under one roof. Their sole purpose is to produce and transmit radio and television programmes that educate and amuse, inform and make one forget. A blending of precise down-to-earth engineering with volatile artistic creativeness must be run on solid, business-like principles, with proper administration and tight financial control.

The main purpose of automation in any large organization is to increase the efficiency of utilization of its human and material resources. Automation can conserve a lot of human effort which is often dissipated in information gathering and dissemination or other soul-destroying routine tasks for the more important duties of decision making and artistic creativeness. The purpose of automation can, therefore, be classed under two broad headings;

(a) To supply the management at all levels with readily accessible and full data concerning all aspects of the organization to help in decision making and in control of all resources, and

(b) Perform those tasks that machines can do better than human beings.

A computerized environment can increase efficiency by fostering forward planning and enforcing discipline of thought and action. However, these conditions are basically alien to most people, who are essentially individualistic. But they will accept these limitations provided they understand fully the purpose of automation, which by curtailing their freedom in certain directions will enable them to develop their talents in others.

PLANNING OF AUTOMATION

As witnessed by many symposia and conferences

on automation of recent years, broadcasting organizations all over the world are trying to harness the enormous potential of computers to provide solutions to their problems. But there are as many approaches as organizations. The resources, aims, methods of operation and even the character of people in each of these organizations are different, therefore there cannot be an ideal universal solution. Solutions must come from within each organization based, of course, on previous experience of others and, if need be, with the help of external experts, but nevertheless they must be generated internally. Only in this way can the right climate for automation be created; widespread understanding of the need for such solutions, acceptance of the methods adopted and willingness to make the system work. Without these ingredients any scheme, however theoretically perfect, is doomed to failure.

Planning of automation can best be undertaken by an internal team formed by computer specialists and representatives of all the departments; administration, planning, production and engineering. The first task of the team is to examine the existing organization as an overall system and determine its main functions. Particular attention has to be paid to the information flow between different departments. The attempt to automate separately the functions into which the system is sub-divded at present might not give the optimum results. Many present systems are sub-divided into separate tasks or functions so that they can be performed conveniently by manual means: human brains and hands. Moreover, some systems have simply grown naturally and have divided themselves into functions due to a variety of causes not necessarily having any connection with efficiency. Computerization of a system might require a different sub-division into functions, or different groupings of functions, for maximum benefit to be derived.

The work of the team should be made known to every member of the organization, and more detailed proposals concerning any department should be freely discussed with the staff of that department. In this way a sense of involvement will be created that will ensure a smooth transition from manual to automatic working.

After formulating the basic plan for automation of the whole centre the team should examine the priorities and establish the stages of computerization, as in most cases it is impractical and uneconomical to attempt the automation of all functions at once. There are many arguments for this phased implementation.

(a) The experience gained during the first phase can be used to modify and improve the plans for the subsequent phases
(b) Gradual introduction will give management and other staff the opportunity to readjust to the new environment, and to learn how to make the full use of the services offered.
(c) Detail planning, system analysis, computer program writing, installation and commissioning of the complete automatic system is an immense task and it would disrupt the functioning of the existing centre if attempted in one step.

AREAS OF AUTOMATION

The broad outline of a broadcasting centre automation is shown in figure 1. It can be seen that there are three main areas of computer activity;

(a) Administrative process
(b) Production process, and
(c) Technical process.

ADMINISTRATIVE PROCESS

In common with all large organizations the administration of the centre includes such functions as staff records, salary administration, purchasing and ordering, accounting and billing. In most centres at least some of these functions are already computerized and they only have to be extended to other activities of the centre.

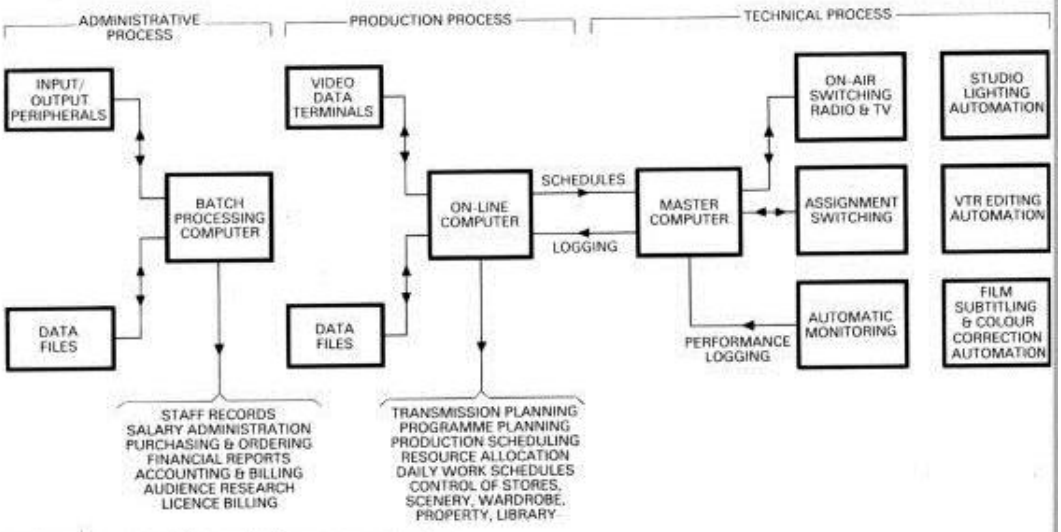

Fig.1 Block diagram of broadcasting centre automation.

Fig.2 Monitor display of a presentation schedule.

In addition to these standard business operations some functions specific to broadcasting, audience research and licence billing, for example, will have to be covered. All these activities can be carried out by a batch-processing computer using standard data processing methods.

Forms in which output data of the computer are presented and methods of feeding the input information for updating of the data files have to be very carefully considered to integrate with the adopted structure of the organization. The amount of information presented to the management should be limited to the minimum needed to enable the individual manager to do his job effectively. More detailed information must of course be available on call if required. Computers, if not controlled properly, have a habit of inundating the management with a flood of data which can be barely more useful than no information at all.

PRODUCTION PROCESS

The efficiency of any operation depends on how well all the resources are utilized; money, equipment and staff. Full utilization can be ensured by proper planning, the more complex the operation, the greater the reward realizable by careful planning of all its constituent parts. The production process covers most vital parts of planning, starting from a long term editorial transmission plan, through programme planning for radio and television channels, production scheduling, resource allocation and ending with daily schedules for individual production functions, e.g work schedules for studio crews, announcers, telecine and v.t.r areas, switching schedules for continuities, etc. Though all these steps can be carried out manually the long chain of communication makes effective control very difficult. A computer with data files covering the programmes to be produced, the resources available with cost of each resource, and budgets for each department, will help to keep a tight financial control, give early warning of any possible overload of resources and enable an evaluation of the effect of changes of one programme on others. The actual costs of each production must be fed to the computer so that budget estimates can be compared with actual expenditure, thus enabling any necessary corrective action to be taken as early as possible.

At the initial stages of programme planning the allocation of only major resources-studios, O.B's, film crews, orchestras etc. — are possible. Daily schedules compiled nearer the actual date must cover all other resources — telecines, v.t.r's, pulse chains, etc. Some requirements, e.g external circuits for news programmes or for viewing might not be known in advance; hence the system must be capable of last minute changes according to the priority of requirements.

Other resources used in production are scenery, wardrobe, property and recorded programmes in store. The library can also be included in this category as being an indirect resource. Manual operation of stores usually means that people take out the required material well in advance, thus denying its use to others. The application of computers, if justified by the quantity of stored material, will increase the utilization by enforcing strict priority of bookings and will cut the time necessary to locate any wanted item by computer programmes enabling a comprehensive cross-referencing of stock. To be really useful the data files must be kept updated and access to them provided from several on-line connected video terminals.

TECHNICAL PROCESS

The application of automation in the technical process to performing well-defined routine operations will eliminate human errors and spread the load of the operational staff more evenly, thus enabling them to concentrate on the more creative aspects of their work. But the design of the system should be such that there is no doubt that the human supervisor is still in overall control of operations and that the automation simply helps him to perform his work more efficiently. It is essential to provide, in parallel to automatic control, a manual control so that the supervisor can override the automation at any time when the need arises. He should also be provided with television type alpha-numerical displays showing the actual state of control and the schedules of the automatic program as much in advance as possible. This will give the supervisor a good chance to take early corrective action in emergencies. A typical display for an automatic on-air switching of television presentation is shown on figure 2. A good communication link between the operator and the computer can take the form of a keyboard from which data (including corrections) can be entered into the memory and the computer interrogated for additional data.

Technical process automation can include the following functions;

(a) On-air switching of radio and television programmes
(b) Assignment of internal and external sources to Presentation, Studios, Exchange Control Rooms, Recording, Viewing Rooms etc
(c) Automatic technical monitoring of internal circuits and links plus automatic switching to a standby facility where such is provided

(d) Automatic editing of video tapes
(e) Film subtitling and colour correction
(f) Studio lighting.

Functions (a) and (b) execute the schedules established by the production process and are carried out according to true clock time; (c) to (f) are more or less independent technical functions having only secondary links with the production process and need not be carried out under clock control.

IMPLEMENTATION

Total automation of a broadcasting centre covers several different functional groups, therefore it can be implemented advantageously not by one very large, but by several smaller computer systems. Administrative process activities can be carried out by a batch-processing computer without any need for on-line connections to the other parts of the system. The production process requires a business computer but with on-line access from several terminals. It should be of a similar type to that used for administrative functions when programmes normally run on the one machine can, in times of high work load or machine failure, be run on the other. Technical process functions can best be solved by a number of independent minicomputer systems with a Master minicomputer to supervise the others and to act as a two-way link between them and the production process computer.

During recent years many automatic systems controlled by small computers have become available. They cover such functions as video tape editing, studio lighting, on-air programme switching for radio and television, etc. Some of these equipments are controlled by purpose designed computers with in-built programmes. This is a distinct advantage since experience has shown that program writing costs represent a very significant proportion of overall costs. By using purpose designed automatic systems the need for a special interface is greatly reduced since the computer can control the broadcasting equipment directly. An example of such a system, an Automatic Presentation Mixer 1 is shown in figure 3.

By using self-contained computer systems for separate technical functions the reliability of the overall system will be increased. In case of failure of the production process computer or the Master computer, the separate automatic systems will still function with additional information, when required, fed manually from keyboards or from punched tape. If only one large computer system is used for all production and technical functions, to ensure the virtual 100% reliability required for transmission, a completely duplicated system would be desirable.

DATA FLOW

Figure 4 illustrates in a very simplified form the flow of data through an automated television centre.

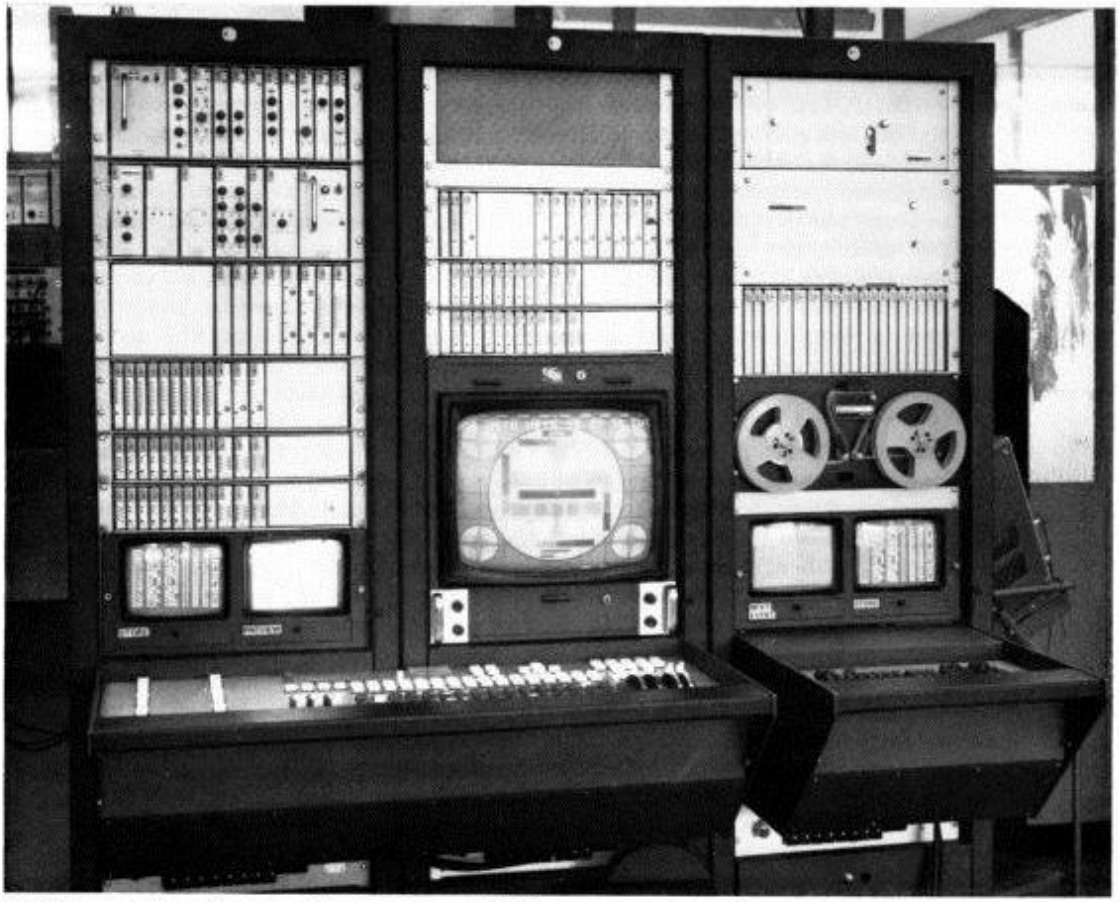

Fig.3 Marconi Automatic Presentation Mixer, type B3727.

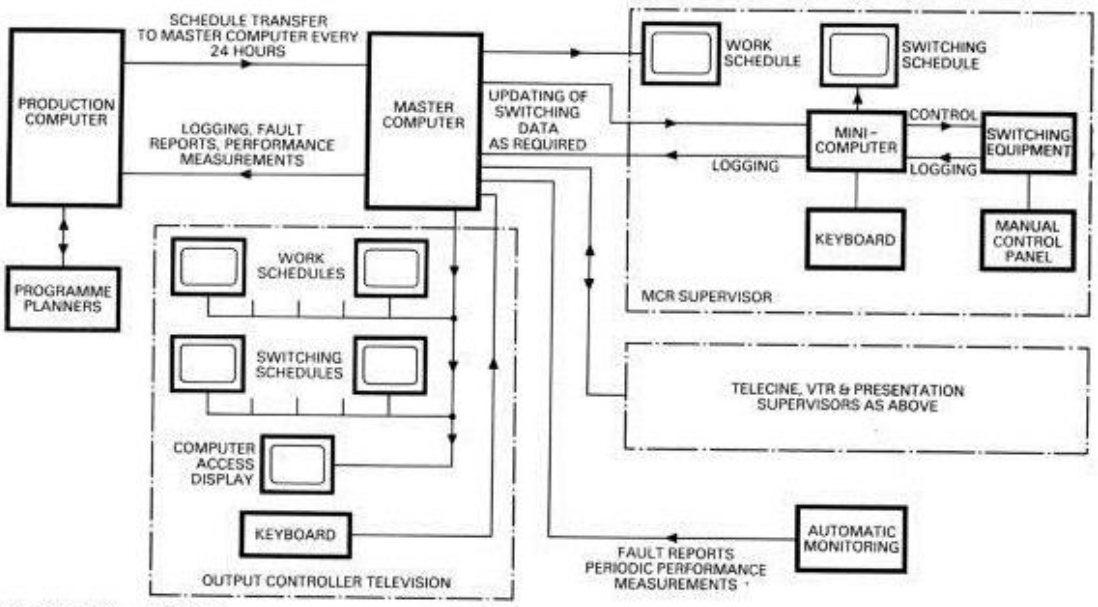

Fig.4 Data Flow – Television.

Programme planners, using the facilities provided by the production computer, are responsible for all aspects of production planning which is usually started up to 18 months before transmission date. The production computer holds data concerning the availability and costs of all resources, technical and personnel. Files are opened for all productions and details are constantly added to them as planning progresses. A master schedule covering all the production activities of the centre is built up from these files and is usually ready about two weeks before the day of transmission. For the following two weeks the master schedule need be updated only with any changes that may become necessary.

On the evening of the day preceding transmission the master schedule for the next day is transferred from the production computer to the Master computer and the responsibility for any further changes to schedules passes to an Output Controller, a programme man who is on duty all through the working hours of the centre. At the time of transfer the memory of the Master computer contains the schedules for the rest of the day and for the whole of the next day. In addition, data covering emergency programmes, for use when for some reason a scheduled programme cannot be transmitted, is stored in the memory. From the Master computer the schedules are distributed to all major operational areas of the centre — Master Control Room, V.T.R and Telecine areas, Presentation Control Rooms, Announcer Studios, etc. Two types of schedule are distributed where appropriate; Work Schedules and Switching Schedules. The more comprehensive are Work Schedules which are connected directly to display monitors and contain all the information necessary for an area supervisor to carry out all his duties. For example, a Telecine Work Schedule may show gauge of film, machine number, type of sound, sound follower number (if used), film identity code, time of assignment and de-assignment, destination area and line number, priority of connection, local or remote position of traction and vision controls. Switching Schedules which contain more limited information are transferred from the Master computer to short-term memories of minicomputers for automatic control of the equipment in each area and are also displayed on monitors. The memories of these specialized computers need not be very large as they are updated when required by the Master computer.

The very nature of broadcasting is such that even in a completely automated centre rigid adherence at all times to prepared schedules is impractical. A programme duration may be uncertain, a programme may overrun, equipment does fail sometimes, external programmes may not be available due to a variety of reasons, or occurrences of national or international importance may demand more drastic re-arrangement of programmes. Not only must the automation system be flexible enough to allow for such changes, but a strict division of responsibilities for making the changes must also be established.

Area Supervisors can only make changes to schedules which do not affect other areas. For example, the Presentation Supervisor can advance or delay any programme, if required, for up to five minutes because the assignment times of sources to presentation are five minutes earlier and five minutes later than the scheduled on air time. This latitude of plus or minus five minutes does not interfere with the operation of other areas. However, the decisions concerning more serious changes must be taken centrally by the Output Controller who is taking an overall view of the situation. He has constant display of all the schedules and access to the Master computer. By interrogating the computer he can obtain the information display in a different form. For example, he can obtain a display of sources

assigned to any viewing room at any desired time, scheduled utilization of any given source, scheduled assignment to any desired destination, a list of unassigned machines, etc. This facility also enables the Output Controller to try out the effect of schedule changes to forthcoming programmes before actually altering the schedules in the Master computer.

In order to obtain a true record of all operations, initiated both automatically and manually, automatic logging of all major switching equipment outputs should be provided. Logging of the presentation mixer output will give a transmission log, a record of all programmes switched to on-air. Logging of the outputs of various assignment switchers will provide information about the utilization of machines, films, tapes and external and internal lines. The logging information, together with fault reports and periodic performance measurements obtained from the automatic monitoring system, are passed back to the Master computer and then to the production computer for further analysis and distribution to the management.

CONCLUSIONS

Total automation of a broadcasting centre is a complex operation and needs to be very carefully planned. Best results will be achieved if most of the planning is done by an internal team so that automation fulfils exactly the needs of the centre. The basic plan formulated by the team must cover the complete computerization of the centre, but should be implemented in stages. The initial step should be made on a limited scale but in all three functional groups; administrative, production and technical. A business computer, capable of future expansion, should be installed for handling some of the administrative functions. This computer could be used initially also for pilot schemes covering some aspects of programme planning, using only batch processing. At the same time a few minicomputers for some of the technical functions, presentation, studio lighting, etc, should be installed. Gradually the number of functions covered by the administrative computer should be increased and when sufficient expertise on programme planning is acquired, a second process computer for on-line production planning functions installed. Production planning automation can then be extended to cover schedule writing and resource allocation and at the same time automation of the stores and library introduced. On the technical side the number of self contained minicomputer systems should be extended to cover all functions and then a Master computer to supervise all the minicomputers added and interconnected with the production computer.

In the light of initial experience the order of some of the steps might be changed, but only planned growth of automation can ensure a complete success.

REFERENCE

1 R. W. Fenton: A New Presentation Switching System, Sound and Vision broadcasting, Vol. 11, No. 3, Winter, 1970.