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RE-EQUIPPING A TV CENTRE

Part 1

INTRODUCTION

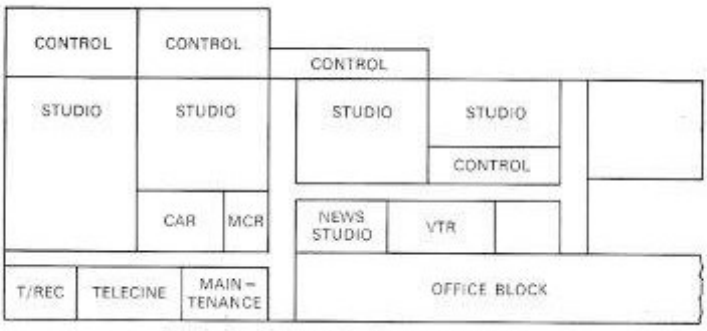
Granada television, along with other Independent Television companies in Great Britain, was faced about three years ago with the need to plan for the complete re-equipment of their Manchester Centre, ready for transmission on 625 lines and future colour. Most of the equipment was ten years old and much was due for replacement or refurbishing. When planning started there were many unknowns which are now resolved but which, at the time, made the task appear nearly impossible. Although a change to 625 lines from the old 405-line system was a foregone conclusion, no date for the change had been fixed and the method by which a whole network would change standards had not been decided. Broadcasting in colour was also a foregone conclusion but the dates for this change were even more vague and the colour system had not been finalized. One further problem was that the licences for the Independent Television contractors were due for renewal and Granada did not know whether a new licence would be awarded to them. It was in this atmosphere of uncertainty that Granada courageously started planning and installing new equipment. The planning of the re-equipment was undertaken jointly by Granada Television and the Projects Group of the Broadcasting Division of The Marconi Company. This article, in two parts, deals firstly with the plans that were made, and the reasons for the decisions taken. The second part, to be published later, deals with the installations and systems that resulted.

Granada Television had from the start in 1956 gradually built up the first composite television centre designed specifically for television in Great Britain, with room for expansion within the existing structures and thus there was no need for new major buildings. An early and fundamental decision however was not to try to re-equip any control or apparatus room while it was in operation. Past experience had shown that attempts at re-equipping an operational area led to disruption of services and further the resultant installation was always a compromise carried out in difficult circumstances giving no satisfaction to either contractors or subsequent users. It was necessary therefore either to find or build a new area for each control or apparatus room or, where only the existing area was suitable, a temporary area was to be found and equipped so that operations could be transferred for the whole period of the new installation.

LAYOUT CONSIDERATION

Attention was first turned to the central apparatus room and a new location was selected as near the electrical centre of gravity of the complete installation as possible to minimize cable lengths. There was no question of disrupting the existing apparatus room as this was located at one end of the building in a totally unsuitable area, a legacy of building in phases as independent television grew in the early years. A prime aim was to create an installation with the maximum stability and reliability and to this end all possible vision equipment for the station and much of the sound equipment was, therefore, to be housed in a single, clean, air conditioned central apparatus room. By housing all the vision equipment associated with studios, master control and where possible telecines in the one room signal paths could be kept short minimizing losses and equalization and timing problems. The Post Office were to be asked to terminate their incoming and outgoing lines to and from transmitters and network in this apparatus room. The ambition then, was to have no programme-carrying vision coaxial cables outside the apparatus room, except those to and from video tape recording machines and from any telecine machines of the flying spot type. Studio control rooms, in some cases a fair distance from the apparatus room were to be linked by d.c. and sound cables only, with the exception of monitor feeds.

The central apparatus room was to be normally unmanned with staff for essential maintenance and setting up located in a central maintenance workshop which therefore had to be situated as near as possible to the apparatus room. The apparatus room is in the centre of the building and has no outside walls – a major contribution to constant temperature as thermal gain and loss would be at a minimum. A suitable location for the maintenance area was found with natural daylight immediately adjacent. The



Final plan of control and apparatus rooms.

layout was designed to give minimum movement between the maintenance benches and the apparatus for both staff and test equipment.

Granada's transmission control is normally manned by a transmission control team with a separate engineers' control room where an engineer is responsible for quality control, network switching and all operational engineering duties associated with transmission and network programmes. Logically it was planned that these two areas should be adjacent with a dividing glass partition to simplify communications and create a better team spirit. Lines testing is normally carried out where the Post Office cables terminate but it was also felt that this position could with advantage be adjacent and with visual contact to the network control room. In the hopefully rare event of breakdown of transmission or network lines these two functions would require the maximum co-operation. It has already been explained that the lines terminations are logically in the apparatus room to minimize cable length. It will be seen that these area dependencies determined the layout of the rooms for transmission control, network control, lines termination and apparatus room in a straight line sequence. The lines termination bays were to be built in the wall between the lines testing area and the apparatus room.

Adjacent to both the apparatus room and maintenance workshop a vacant area was available for the new telecine room but not unfortunately with sufficient room for a VTR area. In the case of VTR it would be necessary to establish a temporary area complete with all facilities, to continue operations while the existing areas were stripped and re-equipped.

BUILDING REQUIREMENTS

Having decided on area allocations for transmission control, network control, lines termination, apparatus room, maintenance workshops, telecine and VTR, the planning team turned to fundamental questions of environment and general building principles.

The basic objectives were defined as follows. For equipment areas maximum reliability and stability of equipment was paramount. In control areas the prime requirement was pleasant well laid out surroundings, functional without being stark, comfortable without being over luxurious or worse somniferous. Good ergonomic layouts and correct lighting levels were to be given the maximum attention.

VENTILATION

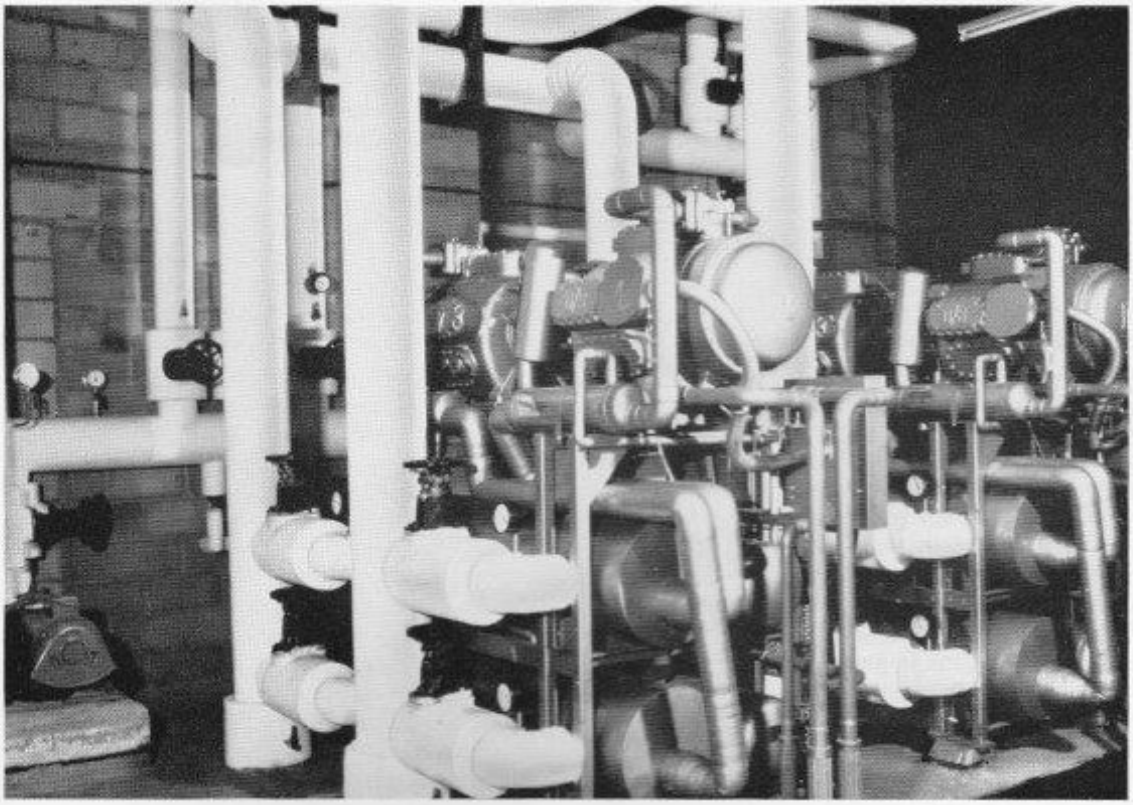
To achieve all these objectives air conditioning was to be installed in all rooms, with automatic humidity control in areas handling film, because the dehumidified air, created by normal air conditions in summer conditions, is pleasant enough for staff but can give trouble with static when film is passed through projectors. To assist in maintaining cleanness of equipment (another contribution to reliability) all the air conditioning plant was to be equipped with double filtration and rooms maintained at positive pressure. The ventilation of the equipment cubicles was designed to introduce cool air via nozzles at high level between rows of cubicles placed back to back. The nozzles were to be adjustable and the air introduced at sufficiently high velocity to be directed at the base or any other part of each equipment rack. The extract was above the racks which meant that no ducts were required below the false floor where they would have obstructed cable runs. The use of the false floor as an air plenum was rejected because of the danger of introducing dirt to the equipment from the cable ducts and because of the difficulty in regulating air flow at the bases of cubicles which were open for cabling purposes. In control and machine rooms ventilated ceilings were planned as these introduce the cooled air evenly over the whole area and require the minimum of input ducting.

The air conditioning was designed round a centralized compressor plant and reciprocating compressors were chosen for low initial outlay in the belief that modern packaged units have a good reliability. As failure of the main compressor plant could cause overheating and possible damage to a very expensive set of equipment, to say nothing of putting the station off the air, 100% spare capacity was installed. The second half of the plant was to be used normally to improve comfort conditions in two of the major studios but could be used for the technical areas in the event of breakdown or during essential maintenance.

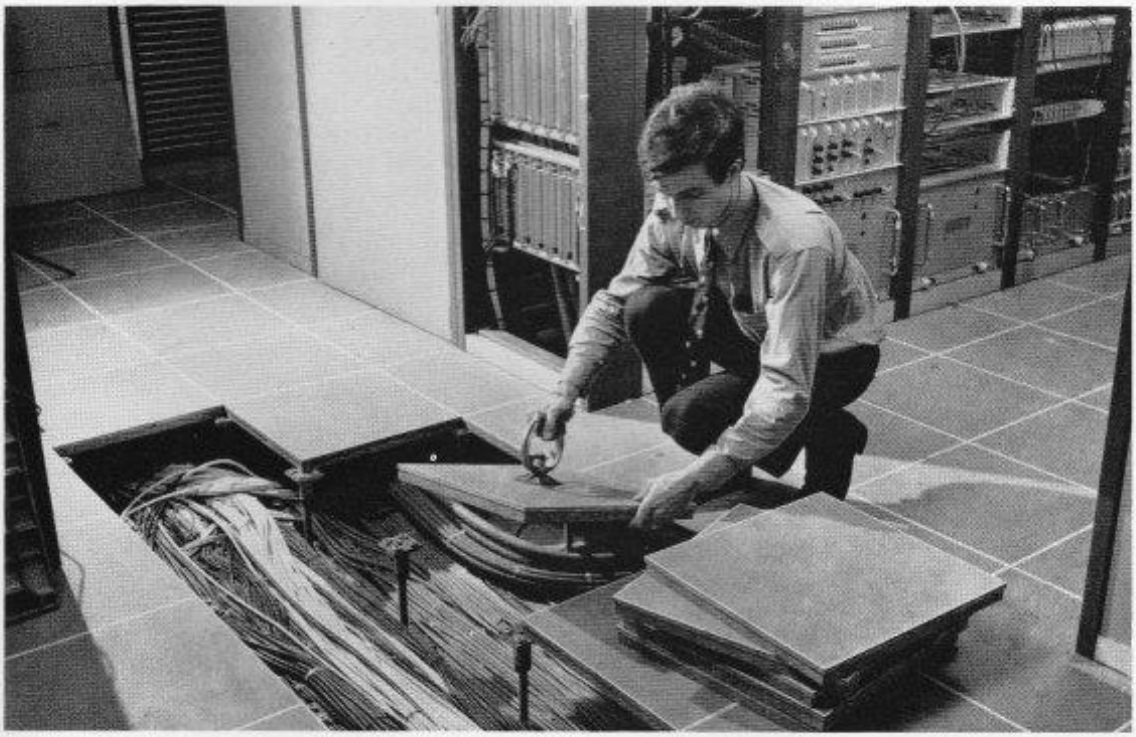
Separate air handling plants were planned for each major area to permit individual thermostatic control of each room served.

FLOORS

In view of the uncertainties outlined at the beginning of this article flexibility was also important and for ease of installation and future change false floors were planned for all areas including corridors between rooms where these corridors were the logical interconnecting cable route. The false floors were to be of modular tile construction known as 'computer floors', although why the computer industry is given credit for this principle is baffling. After exhaustive checks on existing proprietary tile floors, a cast aluminium tile was chosen which was supported on adjustable jacks at each corner without beams known as stringers. Cast aluminium is strong and free from



Centralized compressor room for air conditioning using reciprocating compressors.



False floors of modular construction using cast aluminium tiles.

warping and distortion but is a little noisy to walk on. Tiles can be lifted to give a clear cable duct in virtually any direction. This type of floor is very expensive in terms of initial cost but we were convinced that it would more than repay its cost in ease and neatness of installation and in the ease of extending or modifying the initial installation. These floors were designed with washable finishes for apparatus and equipment areas and with a carpet finish for control rooms. The washable finish aided the near clinical conditions aimed at and the carpet provided the measure of quietness and comfort required for control areas. The ability to swap tiles around to equalize floor finish wear and thus greatly reduce maintenance costs, in some small way mitigates the high cost of this type of floor.

EQUIPMENT

In parallel with building and layout considerations the planning team was considering equipment and systems. As part of the philosophy of keeping all possible vision equipment in the central apparatus room it was essential to have centralized switching equipment to route the outputs from telecine and VTR machines to studios or the transmission/network switcher. This same switching equipment was to switch all necessary controls and communications and any pulse routing required. Before further thought could be given basic decisions had to be made on machine control and pulse distribution.

It was planned that all telecine machines should be capable of being controlled from studios which involved planning for machines capable of reverse running and automatic stop. In shows utilizing film inserts into programmes these advantages, together with the ability to stop, start, and rewind the machines from the studios would save many frustrating manhours of machine minding in the telecine area, particularly during rehearsals when reruns are frequent. In the case of VTR machines it was felt that the state of development was such that remote control of machine start was the best that could be sensibly achieved.

Vision controls of telecine channels were also to be assigned to studio control areas to be under the control of the picture controller. Although colour machines were not a certainty when the plans were made it was thought that control of colour balance from studios was not a practical proposition. If however recent development in digital techniques for the control of telecine machines could have been accurately foreseen then the decision might have been different although not necessarily so. The next decision taken was to equip each set of studio equipment with its own pulse generator. This was done to ensure that pulses in each studio were free from genlocking disturbance created by genlocking requirements of the station or other studios. This was essential because the majority of the studio output hours are recorded and modern VTR machines equipped with time correction equipment cannot follow a genlock disturbance on replay.

In order to operate in correct synchronism with the studio to which they had been assigned by the central assignment switchers, telecine and VTR machines had to receive synchronous pulses from that studio. The machines also had to be provided with 'standby' pulses when not assigned to a specific area and during the actual switching operations.

One further requirement was to switch a feed of the studio back to the telecine or VTR machine for the benefit of the operator. By making this feed of transmission quality for VTR machines it was possible to have a single assignment for either record or replay. Plans for separate assignment of machines for record and replay were therefore dropped. The central assignment switcher had therefore to be specified as being capable of switching vision, sound, pulses, machine controls, communications, and reverse programme.

Considerable thought was given to an assignment switcher to route incoming lines (designated remotes) and studios to the transmission switcher, and to route remotes to studios and VTR machines. The flexibility required here is much less as many of the routings could be made nearly permanent. A composite patch panel was therefore designed with multipole plugs and sockets carrying vision, sound, communications, etc.

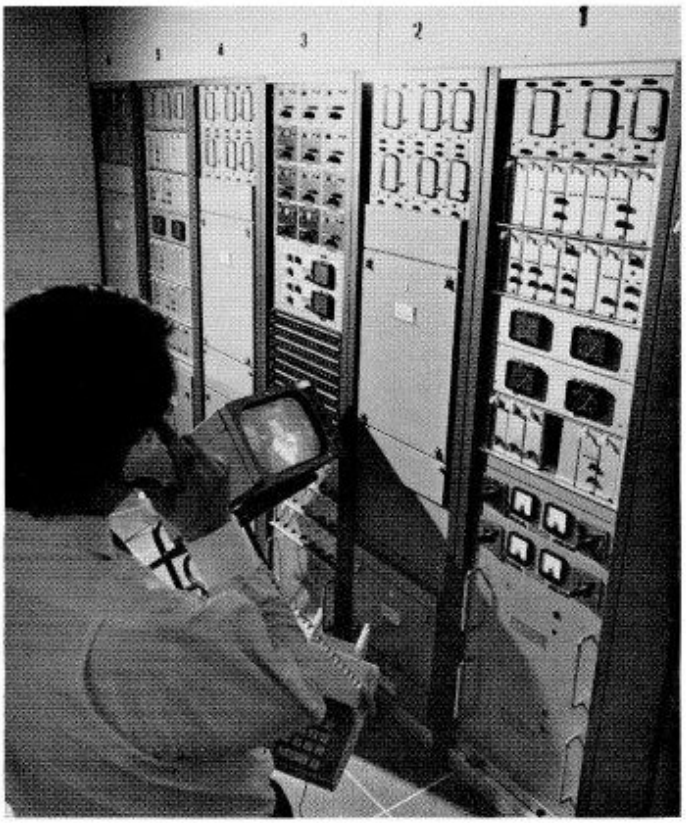
Well equipped maintenance workshop adjacent to central apparatus room.

One last basic decision about the central assignment switching concerned control. Should the source or destination have control of the switching of telecine and VTR machines. The problem becomes difficult when it is realized that a VTR machine is both a source and a destination. It was finally decided to put the control of the routing in the machine areas. The engineer in charge of the area knows which machines he has serviceable or which is most suitable to fulfil each scheduled commitment.

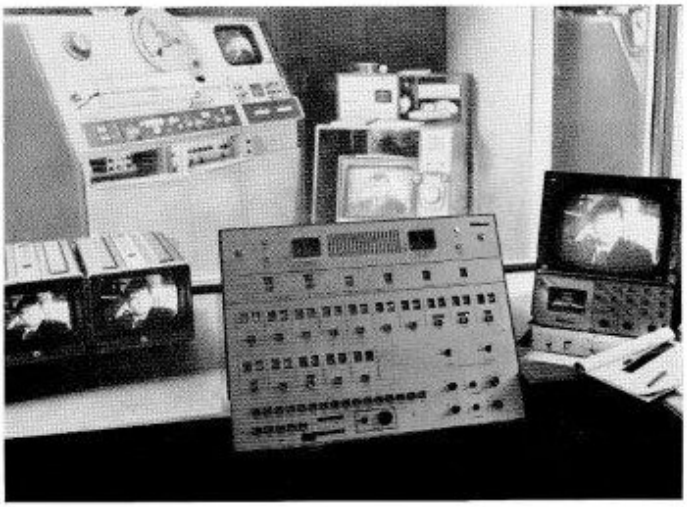
To prevent incorrect routing and to provide composite monitoring the assignment control system was planned so that the operator first selected the machine concerned whereupon he obtained a monitor feed of the sound and vision from it. He next selected his destination, a second monitor, and a PPM displayed the signals, if any, on the line selected. The routing switcher was not to be actuated till a master assign button was pressed. The monitors would then display the same signals indicating that the assignment had taken place.

The next form of assignment considered was camera channel sharing between studios. The problem was analysed from the basic premise that it would be ideal if any camera could be assigned by plugging or even switching to any studio. This involved the assignment of any camera control unit in the central apparatus room (about 18 were envisaged) to any one of about 24 or more camera cables to the various studio floors. Full cue and communications facilities would have to be selected to say nothing of vision and pulse feeds. Timing problems to studio mixers would have been a major headache but again capable of solution. This idea was abandoned but the idea of limited sharing was seriously considered. Each studio was to have a fixed complement of cameras with provision to give one to, or take one from, another studio. This idea would have been pursued in monochrome with a multiple patch system. For colour re-equipment however the idea was finally abandoned due in part to the bulk and cost of colour camera cables, the unknown complications of timing and the realization that the flexibility although undeniably useful would not save actual camera channels as production requirements did not allow any reasonable diversity. It seemed finally that too high a price was being paid in terms of cost, room, and possibly reliability for a convenience.

The choice of the number and type of telecine machines was seriously affected by the uncertainties outlined at the beginning of this article. When the re-equipment planning was started for monochrome only, the main debate was about multiplex or single projector machines and the choice of machines of the flying spot or camera type. These two choices are to some extent interdependent as for all practical purposes the flying spot machines are only available in single projector configuration. The difficulty was further compounded because in Great Britain a large footage of 35 mm film is used in addition to 16 mm. Granada's final choice, which is a good 'eggs in every basket' compromise, was also influenced by the fact that flying spot machines were readily convertible from monochrome to colour operation whereas at that time camera machines were not. The recently demonstrated ability of colour camera telecine to show negative colour film is another important factor in a field of rapidly advancing techniques. We planned for two 35 mm, two 16 mm and one slide, single projector flying spot machines and two 35 mm, two 16 mm, and two slide projectors working with multiplex colour camera machines.



A clean air conditioned environment is required for maximum stability and reliability of equipment.



Assignment control in the VTR area. Panel provides source and destination monitoring and assignment indication.

The phasing of the installation of the machines posed many problems as it was going to be necessary to put the new telecine area into operation before all the colour machines were delivered. The new area had to be ready and in operation when the new central apparatus room was first commissioned which was well ahead of the changeover to 625-line operation. Older machines, which were subsequently to be scrapped, were therefore moved at the time of the transfer to the new area, into an adjacent room. An opening was left between the two rooms to enable an operational staff to work in both. This would allow part of the floor in the new telecine area to be left clear for the new machines to be installed with minimum upheaval. Sufficient new machines were delivered early to enable a minimal service to be maintained in both old and new areas during the transfer.

In the case of VTR machines the choice was between two principal manufacturers and between separate record and replay machines or combined record/replay units. Separate record and replay machines were rejected as full advantage cannot then be taken of the flexibility inherent in having each machine capable of both functions. A total of four machines was considered enough for general service if all were capable of both functions and full advantage taken of the assignment facilities planned. If, for example, three machines are scheduled at one time for record and replay duties then the fourth is available as a standby for either function in the event of last minute breakdown or schedule change.

The planning for the VTR area also included a two or three machine electronic editing suite. Some investigation was carried out into the possibility of introducing computor controlled editing techniques whereby production staff push button edit at leisure on simple helical type machines which are coupled to some form of data store. This data is then later used to programme the main VTR machines to perform the necessary editing. This type of system is very attractive on paper as much expensive machine time is saved and master tape 'passes' are kept to a minimum. Lack of availability of suitable equipment unfortunately ruled out this elegant solution for the present and it was necessary to recognise that the editing suite was going to be used for many hours of every day to meet the editing commitment.

It has not been possible in this article to cover every aspect of a planning and re-equipment programme of this magnitude but it is hoped that the description of our particular planning exercise has been of interest and some help to those with similar problems.

The second part of this article will describe the actual installations that resulted from this basic planning and the layouts of the technical and control areas.