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Some Technical Aspects of the Introduction of a Colour TV Service

by F.C. McLean, Director of Engineering, BBC

After some ten years of argument, experimentation and discussion on the start of a colour service, all is now clear, the system is decided, the date of the start of the service has been decided in broad outline, and we are face to face with the real problem of starting and carrying on a colour service which must be successful right from the start. That we shall do this, I have no doubt, but it does mean a lot of work and it means that we have got to take steps to ensure that the excellent and encouraging results obtained under laboratory and field trial conditions are repeated in normal service conditions.

This of course means that the scale of the operations has increased enormously and the more this increases the more we shall all be pleased. During our long field trials, we had at times combinations of three cameras, one or two telecine machines and a single transmitter at the originating end, and 100 or so receivers at the receiving end. When our service starts, we shall be utilising the output of some 40 to 50 cameras, half a dozen telecine machines, between 20 and 30 transmitters; while on the receiving side we are hoping for hundreds of thousands, if not millions, of receivers at an early stage. The total number of people involved in the provision of services for all this equipment and receivers will go up from a matter of hundreds to many thousands.

As far as the BBC side of this programme is concerned, we have right from the start made our UHF transmitters and transmitting aerials such as they will satisfactorily radiate a colour picture, while the Post Office, who are supplying the programme links to the transmitters, are also making them suitable for colour. These transmitters and links are at present equipped with test equipment only for black-and-white signals, and the staff concerned, with

the exception of those at the London Station, have been occupied only with this type of signal. We have now to equip the whole network with test equipment suitable for colour. We have to get the staff trained in the use of this test equipment and trained in the rather special problems associated with handling colour signals. On the studio side, we are planning to introduce colour equipment in a number of studios, and orders were placed some time ago for nearly ^{forty} fifty cameras. These cameras will be of three different manufactures, all will use plumbicon tubes, some in a three-tube configuration and some in a four. Each of these cameras has merits in one respect or another, and I would not like at the present time to say which type of camera I would regard as the best. I would not even say that any one of these three was necessarily the final design of camera. However the appraisal and putting to work of this quantity of cameras is quite sufficient to be getting on with, and will give us adequate facilities for the start of the colour service. Rather more than half the cameras will be used in studios and the remainder will be used in two outside broadcast equipments that are being built.

For some time now all the telecine equipment that we have installed for black-and-white has been basically suitable for conversion to colour, and this work is being completed. Of our video-tape machines, not all are suitable for colour, but sufficient are being equipped to meet our needs. Together with all this equipment is the large amount of colour monitors, vision mixers suitable for colour signals, test equipment and so on, together with the more extensive lighting installations required for a colour programme.

As well as in the transmitter field, we have in the studio field also to provide for the very much larger staff capable of handling colour equipment. To handle this equipment competently it is not sufficient to know the basic colorimetry and principles of a colour

system, but it is necessary to have built up the expertise in handling equipment required to give quick diagnoses of faults and accurate adjustment of the equipment. We have ample evidence to show that people only achieve this degree of expertise after they have had quite an appreciable period of training and practical experience.

For handling colour signals the test equipment required is much more complex than that required for black and white, and again the quick interpretation of the results shown on the test equipment requires training and experience.

We have therefore put in hand training of two kinds. At our Engineering Training School we shall be giving training in the basic principles of colour television, ⁱⁿ the principles of the test equipment and all the other equipment involved, and the staff will also get some experience with handling the equipment under practical working conditions. We have also arranged for practical training in Studio H at Lime Grove for both engineering staff and for programme staff where equipment will be operated in full studio conditions, and staff will get the feel of handling the equipment under studio conditions.

As far as the Engineering services are concerned, about 200 men will be going through these technical training courses which started in the beginning of this month, and in their present phase will continue well on into next year.

Before we start a regular service, we shall of course be carrying out dry runs of all the equipment, initially without radiation, but then with radiated signals in order to try out every aspect that we can, both of the equipment and of the men before we are committed to an announced service. This we feel is of the greatest importance. We have got to ensure that at all times the colour pictures radiated are of first-class quality. The public is likely to be more conscious of quality in colour than it is in black

and white , because the eye recognises irregularities of hue more than it recognises changes in the grey scale. In black and white, if a face looks whiter or darker than it really is, nobody knows or very much cares. But in colour, if the complexion does not look natural, everyone will care very much, and this goes for other things besides complexions. The overall picture seen by the public is dependent on not only what we do at the originating end, but what industry does at the receiving end. Whereas we have perhaps hundreds of pieces of equipment to look after, industry has hundreds of thousands. In this connection I think we have to take a look at the American experience and resolve that it should not be repeated here.

In the United States colour got off to a very bad and slow start. There quite a number of reasons for this; firstly, the receivers were rather expensive, but I do not think this was ever a very serious deterrent. The deterrent really was that the colour picture as seen in the home on the ordinary receiver was so very variable. At times it was very good and at times, and indeed a high proportion of the time, it was very bad. This arose I think from the fact that, although their cameras were good, they had an insufficient number of trained staff to keep the results always at the top level. Their colour recording facilities were poor, and I think their transmitters were not lined up as well as they should have been. I think however the greatest failure was in the receivers in the hands of the public. Electrically these were not as stable as they should have been and were rather difficult to tune and maintain in registration.

As I have said, on the transmitter side I believe we have taken adequate steps to see that our equipment and men should be better than those available in the early days in the United States, and I think better than most of them at the present time. The receivers in this country will be better than the early American receivers, and

with the easement that the PAL coding system gives the receiver should be somewhat easier to handle. There is however a lot in a colour receiver which requires accurate adjustment and maintenance outside the decoder, and in these respects all systems are in fact equal.

If a black-and-white receiver has a poor frequency response the picture will be fuzzy. If the linearity is poor the picture will lack detail in the whites or in the blacks or perhaps in both. If it is de-tuned the picture will be degraded, but unless it is so de-tuned to the extent that the picture is broken up, the overall picture will still be acceptable to a large number of people and there will probably be no complaints. When we come to colour, however, the situation is different. If the frequency response is not adequate then there will be no colour component at all or there could be severe attenuation in the colour. If the linearity is not adequate, then colour fidelity and colour tones will be affected. If the tuning is wrong then the colour fidelity will be seriously affected. There is a certainty, of course, that the public will be much more sensitive to errors in colour pictures than they are to errors in a black-and-white picture. It is, in fact, hard to recognise whether the black-and-white reproduction of a scene accurately represents the scene, but it is very easy to see when colours appear to be not what is expected. Also, of course, a black-and-white picture has a single image. In colour, however, there are three images which have to be accurately super-imposed one on top of the other over the whole face of the tube. This is not too easy to do or to maintain, but we have to take steps to see that these objectives are achieved. Nearly all these factors have very little or nothing to do with the type of coding employed and are inherent in any colour system. Although PAL in some respects gives some easement there are, of course, more components and more operations carried out in the PAL receiver than there are in the NTSC receiver.

There will be therefore a very urgent need that the radio service man should know his job, should be adequately equipped with the appropriate instruments for setting up a colour receiver, and should be given adequate facilities to gain that expertise on dealing with matters without which quick and accurate diagnoses are impossible. If, however, we do all that we ought to do in these matters, I am quite sure that, when the colour service starts officially towards the end of next year, we shall have a colour service which, technically speaking, will be second to none.

FCMcL/CVG
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Discussion at Mullards

Ken Wood - concerned with reviewing

Allehurst says that 17A may that 405
line rates would be 10 times that of
cable or 625 lines.

Croydon - wants character of BPC 2 should
be changed