

DRAFT VERSION — NOT FOR PUBLICATION

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Working Title

"USER SPECIFICATION FOR VIDEO EDITING SYSTEMS SUITABLE FOR COMMUNITY USE"

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Research commissioned by Greater London Arts Association Film Video and Broadcasting Committee

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Carried out with the assistance of video workers in the UK and abroad.

This research is made necessary by the lack of suitable, editing machines on the market. The requirements of mass production and marketing do not match the requirements of independent, grass-roots video workers.

Many of the technical problems currently experienced are a result of this one fact. Were there a half-inch, solenoid operated reel-to-reel editing deck on the market, this research would be largely unnecessary.

The Greater London Arts Association is to be congratulated in having the determination to initiate a programme of research and development intended to fulfil the needs of a growing number of independent, non-commercial video users. It is hoped that other bodies with Regional and National responsibilities will respond to this initiative and produce the backing that even a modest programme requires.

BRIEF

"To research and write the video workers' technical specification for an automated half-inch video editing facility suitable for community use".

Discussion

1 No-one in the UK is using colour portapak yet, they are all black-and white. The next generation of editing machines will be colour capable. We have confined our specification to black-and white editing, on the understanding that colour-capable systems are not necessarily excluded.

2 "Technical specification". We used software and operational criteria in writing the specification. A full technical interpretation requires the services of a video engineer, using this report as a starting point.

3 "Automated". The exact level of automation is a technical question which cannot be precisely answered until a system design is produced by an engineer responsible for research and development of prototype(s).

4 "Half-inch". During the research we encountered video editing using half-inch reel-to-reel, half-inch videocassette(VCR), 3/4" videocassette (U-Matic), and 1" editing decks. In the future there may well be systems employing these edit-deck options.

5 "Community"

(a) There is considerable debate as to the meaning of this term. We take it to include both 'local community' and 'community of interest' (which evidently includes the community of non-commercial video users).

(b) Most 'local community' use of video editing systems is done by video resource persons under the instructions of the producing group. This is partly due to the time that editing takes, and would apply even if automatic systems existed. Practically, the great majority of the handling of video editing systems is expected to remain in the hands of experienced video users.

DESIGN PHILOSOPHY

1 It is not worth spending a lot of money on modifications which will only fit the present generation of machines.

Reasons:

Present editing decks will be superseded within the next 12 months by machines with higher performance and versatility. However, these new developments are not totally predictable and one cannot make assumptions based on manufacturers' forward publicity, particularly with respect to launch dates.

2 It is better to modify standard production models as little as possible.

Reasons: }

Each modification R and D'd increases the cost of development of the programme as a whole.

Each modification may produce other problems within the machines, which in turn will have to be resolved.

3 Electronic modifications are preferable to mechanical modifications.

Reasons:

It is harder to predict wear and tear, fatigue on mechanical mods.

Electronic systems are inherently more adaptable than mechanical systems.

(These are also the views of our technical advisers).

4 There will be a trade-off between an ideal system and costs and development time necessary.

5 Development of control hardware has a higher priority than machine-specific modifications.

Reason: Time-coding, pulse-counting and ancillary control hardware could be used with later generations of editing decks, unlike machine-specific developments.

6 There will be a trade-off of user requirements now against longer term objectives.

Reason:

Few current users have experience of automatic editing. As experience grows, the emphasis in their points of view will change.

7 Anything developed in this programme must be an improvement on the Australian and other current versions of the Videographe system.

USER REQUIREMENTS

Introduction

User requirements collected covered a much wider range than just half inch black and white automatic editing systems. Shooting, processing and post-production are all inextricably-linked with the editing process.

Requirements not directly related to the brief are therefore included in other sections of this report. For instance, a design change in the portapak may make editing easier, and could therefore be considered as a possible improvement in the performance of an editing system, but will be referred to under Portapak.

No stated user-requirements relating to editing were rejected by the authors. But the ordering of priorities was determined by our interpretation of the brief, as described in the sections Brief and Design Philosophy.

The points listed under Essential Minimum Requirements are considered a sine qua non for the development of any new system. Those under Other Requirements are not rejected, and should be considered for inclusion where it is technically cost-effective to do so, or where a longer-term development programme is undertaken.

Users observations fell into 3 broad categories: Convenience, Versatility and Technical Quality. These are all felt to be of equal significance.

ESSENTIAL MINIMUM REQUIREMENTS

CONVENIENCE

* Speed and Ease of operation

- 1 Small number of operations required to perform an edit.
- 2 Automation: timing, counting and sending edit instruction should be automatic, i.e. none of these to be done manually by the operator.

* Visible Instrumentation

- 3 VU meters for Audio and Video Record levels.

* Rehearsal Mode

- 4 An automatically repeatable rehearsal mode, including return to edit point after rehearsal, enabling adjustment of edit points if necessary.

* Ergonomics etc.

- 5 Both decks should be able to take a 1-hour tape.
- 6 The system should be logically and comprehensibly laid out.

* Manuals

- 7 A simple, easy-to-use instruction manual should be provided with all systems.
- 8 Maintenance procedures should be described for (at least) the following adjustments: Tracking, Tape Tension (Skew), Brakes, Clutch, Speed Checks, Line-Up Checks, etc. This requires tools, test equipment, an instruction manual and skills.

* Cost

- 9 Cost to user should be low.

* Ease of Access

- 10 Requires flexible hours of opening, non-bureaucratic administration, good publicity (these considerations apply to Resource Centres in general).

VERSATILITY

* Flexibility of edit modes.

11 These modes are essential: Video Only Insert, Audio Dub, Video plus Audio Assemble. Choice of other modes may involve some trade-off of flexibility against cost and time of development. However, there may be a technical option here in which a control track is laid down first, and all video modes are insert modes. The above priorities still apply.

12 Optional manual override for audio record, enabling it to be operated separately from video automatic editing.

13 Be able to hear audio played back from edit deck while doing video only insert.

* Flexibility of System.

14 Option of making roll-back time longer for use with genlocks, which take up to 4 secs to lock. If standard roll-back is 6 secs, this would increase it to 10 secs.

15 A simple 2 x 2 patchboard would enable the versatility of the system to be greatly extended by patching in all or any of the following: Audio Mixer, Graphic Equaliser; Video Mixer with Genlock, Process Amplifier, Time-Base Corrector. While some of this ancillary hardware is very expensive, the patch-board is very cheap to produce.

16 Using the patchboard, a cheap, simple audio mixer can be used with the system (to be supplied separately).

17 Using the patchboard, a simple genlock mixer can be used with the system to give caption super. (to be supplied separately).

TECHNICAL QUALITY

* Accuracy

18 Vertical Interval Editing.

19 Tolerable accuracy at edit point, ± 2 fields (± 1 frame), enabling editing between words on audio track(s).

20 To change machine modes from still to fwd or rewind (depending on the actual system) after edit point has been selected), without holding the reels or losing the frame chosen.

21 No time lags in switching at any point.

22 Maximum stability of playback deck signal. This would apparently require either a capstan servo, or an inbuilt crystal-sync generator, on playback deck.

* Quality of recorded tape

23 No audio mixing or clicks at the edit point, or when edit deck is stopped after edit.

24 No video or sync disturbance before, during or after edits. This includes interference, moire, changes in tracking, frame-roll etc.

25 There should be no restriction on how close edits may be to one another in time.

* Compatibility

26 The playback deck should have full EIAJ-1 High-Density specification.

27 Edited master tapes should be able to be played back on any EIAJ-1 High Density deck.

* Essential ancillary hardware. If the system is to viable for users wishing to make distribution dubs from the edited master, it must include the following:

28 Audio Mixer. Enables fading and mixing of several signals e.g. the dubbing of music or commentary while editing.

29 Video Process Amplifier. This performs several functions, the most relevant of which are:

(a) Sync replacement.

(b) Grading i.e. the ability to balance the contrast and brightness ratios of different shots.

OTHER REQUIREMENTS

CONVENIENCE -- HI PRIORITY

* Foolproof Fail-Safes

30 Abort Edit button, enabling either immediate stop or switch to rehearsal mode, in case of last-minute decision during rundown to edit point.

31 Built-in safety interlocks to prevent damage to system caused by e.g. a wrong sequence of operations.

32 Tracking meter on playback deck.

* Redundancy

33 Build in redundancy for back-up in case of partial breakdown, i.e. decks to be interchangeable.

* Ergonomics etc.

34 Comfortable operating position, lighting, etc, with controls, decks in easy reach of operator(s).

35 Good visibility of pictures on properly adjusted monitors.

36 Good speakers (better than those in monitors).

CONVENIENCE -- LO PRIORITY

* Reliability.

37 Use machines with a good 'track record' if possible.

* Ergonomics.

38 Ideally, all controls including Fast Forward and Rewind would be on a hand-held unit.

VERSATILITY -- HI PRIORITY

* Flexibility of Edit Modes.

39 There should be a full choice of edit modes i.e. Video plus Audio assemble, Video only assemble, Audio dub; Video plus Audio Insert, Video only Insert, Audio only insert.

40 Sequential mode operation. Ability to change editing modes after the first (automatic) edit has taken place, with the machines still running e.g. follow video plus audio insert with audio only Insert, etc.

41 Edit still from playback deck on to edit deck.

* Miscellaneous

42 Solenoid operation of the following VTR functions in edit and rehearsal modes: roll-back, roll-forward, stop.

43 System should not have a long warm-up time.

VERSATILITY -- LO PRIORITY

* Remote control and Search

44 Remote solenoid operation of all VTR modes including Fast Forward and Rewind, which would enable automated searching to be developed at a later stage.

* Miscellaneous

45 To retain original functions of automated decks, enabling optional use as manual editing system.

46 System should play in reverse, giving a visible picture on screen during roll-back, rewind.

47 System should play in reverse, giving editable signal.

48 Animation. Several users expressed strong interest in developing a frame-by-frame animation system. This is currently in development at the National Film Board of Canada.

49 Audio remixing. Should be possible to take off, mix and replace audio in lip-sync. This would require a sync. locked 4-track audio tape recorder with sound-on-sound recording.

TECHNICAL QUALITY -- HI PRIORITY

* Signal stability and quality.

50 Drop-Out compensation. Replaces a missing line of picture information by the previous line. A feature of some next-generation decks.

51 Time Base Corrector. The inclusion of a TBC would ensure adequate technical quality for interfacing software produced on this system with Broadcast.

52 Built-in check on accuracy of alignment between decks as they run down to the edit point which will either signal or abort if they are further apart than the tolerable accuracy. This allows for looseness of mechanical tolerances and change in climatic conditions which may occasionally be too great.

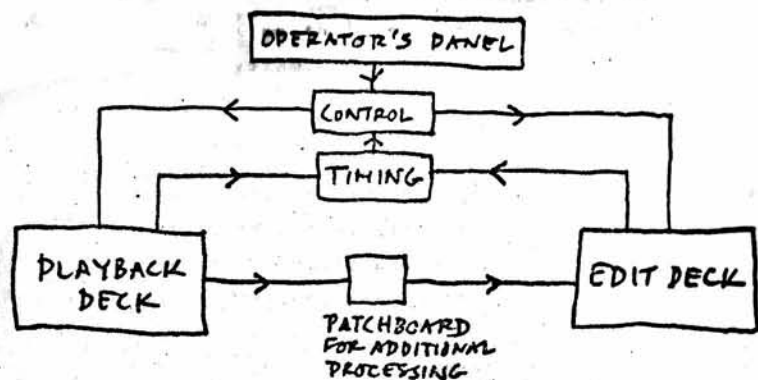
TECHNICAL QUALITY -- LO PRIORITY

* Miscellaneous.

53 Ideally, there should be an exact way of identifying the edit point by the producer group in advance, but this awaits the development of either time-coding for portapaks, or accurate tape-elapsed time counting.

54 If there are numerical pulse readouts, they may be either in a separate display, or on screen. (not much cost difference).

55 Feed deck to be switchable between high and low density EIAJ 1 tapes. This is not essential as the proportion of high-density portapaks is at least 70% (end 1974) and increasing.



OPTIONS

Short term options (6 to 12 months)

In the absence of an existing half inch solenoid operated high-density deck on which to base an automatic editing system, the only choice is to work with existing decks and modify them.

The only existing decks are the Sony 3670, the National 3030 and the Hitachi-Shibaden 600 series. The Sony is high density, but the least flexible, and has been described as the worst possible deck to use in Resource Centres (Australia). The National and Hitachi decks are both low density, and both will be superceded within the next 12 months by high density decks. Sony (UK) state that at present they have no plans to supercede the 3670. However, an automatic system based on the Sony is at the stage of prototype testing in Australia. (This follows the Canadian Videographe development based on similar, but different American standard Sony decks). The Australian Council have plans to market kits, and complete systems, perhaps through a small commercial enterprise.

Although this system is likely to suffer the disadvantages inherent in Sony Decks and non-pulse counting timing, the R & D has been done. In the short term, any system developed would not only need complete R & D (if based on non-Sony decks), it would have to deliver a significantly higher performance.

In the short term, then, the most likely option is to import kits for conversion of Sony 3670s from Australia, devoting immediate research capability to:

- (a) Improvements to this system with long-term applicability
- (b) Investigating the feasibility of other options outlined below.

(a) Developments with long-term application are those that are not machine-specific i.e. in the control and timing parts of the system. The drawback of the Australian system in the control and timing parts is that the timing is done by electronic timing circuits and not by pulse counting. The development of pulse counting and control mechanisms would be an optimum step.

Two other independent developments indicate that this is the right course to follow, and their progress will likely do most of the necessary R & D.

- (i) The National Film Board of Canada's animation frame-by-frame editing system based on the 3650 type deck probably uses pulse counting to attain this accuracy. If this is so, it could be achieved with European standard 3670 decks.
- (ii) An edit run-up pulse counting and display system suitable for any decks will shortly be R & D'd by Snell and Wilcox Ltd for Milton Keynes Development Corporation.

A short-term research target would therefore be to combine the MKDC development with the existing Australian system, referring to any useful information from the NFBC animation programme. This should include a patchboard and any other immediately-achievable essentials. Advantages: Cheap, easily achievable.

Disadvantages: Inherent lack of proper video insert mode on Sony deck, inability to monitor audio during video insert, no proved long term mechanical reliability of Australian modifications.

Possible solutions to video insert disadvantage: incorporation of flying erase head assembly from Sony 8650 series into 3670 decks; incorporation of double control/audio head from National 3030 series into 3670 decks. These and other possible options resulting from the combination of parts from different series machines should be checked for feasibility by a video engineer.

The viability of the Australian system should be checked against the forthcoming report on their prototype development, and against tapes edited on the system.

Medium Term Options

The target of a medium term programme would be to develop a new deck based on 1976 high density editing models, coming as near to a fully automated, solenoid ~~ad~~ operated editing deck as possible, combined with pulse counting and control systems, and maximum flexibility at the editing point. A likely candidate is the National 3060, but there may be a trade-off between full automation and flexibility. There would seem to be 2 pathways towards the ideal system:

(i) Conversion of existing solenoid-operated decks into edit decks by the addition of parts from editing series machines.

(ii) Fully or partially automating the new series of editing decks.

(i) Advantages. Most of the modifications would be electronic rather than mechanical, although precision mechanical work is involved in fitting new parts. Fast forward and rewind are already fully automated: this could permit automatic search procedures when combined with non-recorded tape-elapsed-time address coding, currently being marketed in the USA, by Datatron.

Disadvantages. This is a completely untried solution, which after an initial feasibility study would need to be R & D'd from scratch, and is likely to prove expensive.

(ii) Advantages. The new series of decks are likely to include some or all of the following: switchable between high and normal density tape; flying erase heads giving proper insert; vertical interval switching; dual audio head for cleaner audio inserts; built-in drop-out compensation; colour capability.

Disadvantages: Full automation presents the same problems as presented by the mechanical modifications to the Sony 3670: a large amount of mechanical modification which is liable to wear and fatigue. (However this might be solved by proper small-batch manufacturing techniques allied to good materials research and heavy testing.) Would again need to be R & D'd from scratch after a feasibility study by video engineer.

However, there may be a further option--partial automation. In this type of system roll-back is activated by manual operation of the rewind lever. Counting and stop are automatic, but the machines have to ^{be} re-set before running down to edit. The edit sequence is completely automatic. This would be achieved by the installation of a DC motor whose speed could be varied down to zero.

Advantages: No extensive mechanical modifications or installation of solenoids; few electronic modifications; relatively low cost.

Disadvantages: This is a completely untried solution, and would require a short feasibility study. Subsidiary problems could be losing the exact place during manual machine operation; uncertain start-up behaviour rolling down to edit may cause inaccuracies. Larger number of operations required to operate than on Videographe system, slightly more skill required.

It is assumed that pulse-counting timing and control systems are applied to all medium term developments.

The medium term lasts until a manufacturer brings out a high density, solenoid operated, next-generation edit deck. Apart from Hitachi, who have not declared their intentions, no manufacturer is expected to bring one out in the next 2 years, according to their own statements.

Associated Developments

1. In USA there are already available time-code editing systems suitable for using with low-gauge solenoid-operated decks. These are of two basic types:

(i) Systems using tape that is time-coded during shooting, requiring time code generator at this stage.

(ii) Systems using tape-elapsed-time readout as on-line coding. These do not require a pre-coded tape to function.

These systems are the only ones giving true single frame accuracy, and therefore permit accurate editing instructions to be generated at the logging stage by a producer group, who do not have to be present at the actual editing session. They also permit automatic search and retrieval, which further reduces the time taken in editing, especially in on-line/off-line systems.

2. Portapaks. Year-by-year manufacturers upgrade the performance and capability of portapaks. At the same time custom-built improvements are being designed and installed, and are widespread in the USA e.g. those offered by Technisphere Corporation. As has been stated before improvement in portapaks leads to improvement in editing quality.

3. Video Processing. Time-base correctors, sophisticated process amplifiers, aperture correction and genlocks are being developed suitable for low-gauge video e.g. Quantel TBC's, Electrocraft Processors, National and other genlock mixers. As integrated circuits are mass-produced, the cost of these items drops, sometimes rapidly. Since availability at this time is largely a matter of cost, this should improve in the future.

Long-Term Options--the Super-System

This would be based on a new generation of solenoid-operated edit decks, and would incorporate time-code editing, search and retrieve, processing to broadcast standard between decks, colour capability and total remote control of all functions. Such a system could be run in conjunction with a computer.

The dramatic growth of Electronic News Gathering using computer controlled Sony U-Matic 3/4" Videocassette machines by many broadcast stations in the USA means that at the 3/4" level such a super-system already exists. In the future it remains to be seen whether cassette and reel-to-reel can exist side by side.

RESEARCH METHODOLOGY

Collection of information.

1 Letters were written key persons in other countries concerned with the development of automatic editing: administrators, small service companies, users.

2 Video workers were invited to visit an informal gathering at our premises on Saturday November 1st, 1975. A room was set aside for the display and collection of this information as an on-going 'think-tank'. User comments were written on a paper-covered wall so that all comments could be referred to throughout the day. Representatives of 24 different video groups attended, including some individual artists.

3 A selection of video workers unable to attend the gathering, including some distant from London were briefed by phone and their responses recorded by phone (with their consent) 24 hours later at our expense. Representatives of 11 different groups participated, including ~~xxxx~~ one group (Inter'Action) that attended the gathering.

Sorting of Information

The information was transcribed item by item and sorted a total of 4 times, as follows:

1st Sort: Editing Systems Technical Features; Editing Systems Handling Features; Portapaks and Logging; Production and Processing systems (incl. editing); Other comments; Users Questions.

2nd Sort: Half-inch automatic editing; Remainder.

3rd Sort: Convenience; Versatility; Technical Quality.

4th Sort: Essential; Hi priority; Lo priority.

The criteria employed in these sorts are outlined in Brief and Design Philosophy.

APPENDIX

Points raised falling outside the brief, sorted as follows:

- The Portapak
- Logging
- Training
- Comments on editing
- Processing and Post Production
- Distribution and Dubbing
- Comments and questions on the development programme.

THE PORTAPAK

- * Portapaks should be improved. To some extent this is already happening e.g. new Sony Rovers are progressively updated by the manufacturers.
- * There should be a means to check if the portapak syncs are of requisite quality, the picture stable e.g. waveform monitor and/or oscilloscope.
- * There should be a means to check on portapak running speed (authors note that there is a simple way in which this can be done.)
- * Any group regularly depending on a portapak for its work should have 2 portapaks (redundancy).
- * Planning for editing. An adequate run-up should be left on the front of every shot: minimum 6 secs, ideal 10 secs.

Preferable modifications

- * Black level clamp (which stops to black level drifting to gray, esp in low light conditions).
 - * Video should be switchable from AGC to manual: where there is sufficient experience on the part of the operator this will give better results e.g. in lighting a scene before shooting, in shooting against the light, etc. This needs a VU meter for level.
 - * Video : to be able to see the picture on a monitor while recording
 - (a) to have a cheap RF adaptor enabling the use of domestic TVs.
 - (b) to have an adaptor in the camera lead with monitor connection.
 - (c) to install a video out socket on portapak.
 - * Low light tubes. These enable shooting under normal room-lighting conditions and even lower light levels.
 - * Lenses. Versatility greatly increased by the use of a wider range of C-mount lenses, such as are used for 16mm movie cameras.
 - * Microphones. Those supplied for the portapak are unable to use the recording performance of the tape. Quality can be greatly improved by the use of better mics., such as those used by people doing professional audio recording, including mixers.
 - * Radio mic. mod. This enables much greater flexibility of recording as the mic doesn't have to be connected to the recorder by a wire. Usually expensive, a cheap devt. is under way in Australia, and at the Albany (S.London).
 - * Audio AGC should be switchable from AGC to manual, with a VU meter for level control.
- [Merseyside VCU reckon that another way round audio AGC is to record separately e.g. on Uher. then post-sync]
- * Mini-jack sockets are fragile and should be replaced by cannons.

* If a time-coding unit could be developed for use with the portapak, this would be very useful as an aid to logging and automatic editing control, computerised systems, etc.

* Shoulderbrace, which stops random camera shake almost inevitable with hand held cameras. These could be very cheaply made if simple. They cost 60.00 and upwards on the open market.

* A unit enabling 2 cameras to be driven off 1 portapak, with cutting or mixing between them.

All these modifications--with the exception of small, portable time-coding have already been successfully done on American standard portapaks, and many of them are offered as 'standard' mods by small commercial companies in New York e.g. Adwar Corp, Technisphere Corp.

* Portable color video is eagerly awaited by some users.

LOGGING

Many non-video users do not understand the need for logging and editing script. More time is used in this stage than in editing itself. It includes viewing and becoming familiar with raw tapes; making a timed log order and length of shots, start and stop times, start and stop cues, content notes and other quality comments; making an editing script, with an exact notation of edits, in and out points, and their sequence for editing.

Because different decks--even from the same manufacturer--have different counter number systems, finding one's way through the raw tapes at editing is a tedious business. Conversion charts are some help, but time-coded tapes are needed for accurate logging. If this were possible, a producer group could specify editing exactly, without necessarily having to do the editing themselves--which would aid public access.

* A playback VTR with speed intermediate between fast and play would help logging.

TRAINING

There is a generally-felt need that training for logging is desirable. Training for editing is also needed. The development of short, efficient training programmes/ courses for production would again aid public access.

* First time users must be able to learn to use the system in a short time.

COMMENTS ON EDITING

* Reel-to-reel/cassette/cartridge.

(a) The simplicity and hands-off operation of cassette and cartridge-loaded decks mean that these options are not necessarily ruled out.

(b) Tape life is greater with cassette/cartridge than hands-on reel-to-reel decks.

(c) Using cassette/cartridge would mean low-gauge users changing their editing methods which at present make use of a lot of hands-on 'inching'.

* One user suggested a 'display meter board' that would enable people to map out the shape of a piece of software on the macro level, while concentrating on the micro level of editing--on a blackboard or whiteboard with an automatic pointer linked to the edit deck.

* A line-up tape should be provided with every system (and test cards for cameras).

* The best known editing system is at Electronic Arts Intermix, New York, using converted Sony 8650 half-inch edit decks.

* Automatic editing should become commonplace.

* An unmodified Sony 3670 is the worst editing deck.

* Community users. Many do not have the time to get involved in logging and editing, which is often left to the video worker. One group felt that fine editing should be associated with long-term community projects.

* Separate viewing systems should be provided, preferably at the editing centre, which would enable viewing and logging to be done separately but near at hand. In the longer term this would allow a more intensive use of editing system on time-shared basis.

PROCESSING AND POST-PRODUCTION

* For video processing maintaining maximum quality the following are needed:

- (a) Time-Base Corrector , expensive now, cheaper later.
- (b) Processing Amplifier (Procamp).
- (c) Drop-out compensation

For increasing the scope of production:

Mixer with genlock incorporating special effects generator. This would effectively add a small studio to an editing facility, and make crossfading, caption super, feedback possible.

* A animation system would be good for working with kids.

* A video synthesiser (and color capability) would also add to scope of production.

* A vision selector is much cheaper than a vision mixer and would be a simpler and cheaper alternative.

* Audio. A 2-channel graphic equaliser , and simple audio mixer would aid quality. A 4-track capstan servo audio recorder with sound-on-sound would be valuable.

* Titling. A quick method of making titles for camera. Electronic caption generators are getting cheaper.

* A caption camera suitable for interfacing with slides, print, 8mm film, etc.

DISTRIBUTION AND DUPLICATION

* Users looked forward to the time when hi quality 525-625 and 625-525 standards conversion would permit exchange of tapes between Europe and N America without optical-dubbing quality loss. [Quantel have just brought out a Frame Store Converter with a 3 megabit memory which may be suitable.]

* If there is an editing facility there should also be a duplicating facility which can go from any standard to any other standard, including transfer to film (kinescope). Very suitable for a medium-term distribution strategy on e.g. 16mm film cf. National Film Board of Canada.

* Large screen projectors currently available would be an asset for theatrical showings and performances.

COMMENTS AND QUESTIONS ON THE DEVELOPMENT PROGRAMME

* When and how will the system be available in the UK? The prototype should be kept at an accessible point so that many people can test it.

* What is the lifetime of the system developed going to be?

* Research work should be carried out and fed back to the manufacturers. As well as modifications there should be continuous testing of new machines.

* Possible further sources of funding for development programme:

- (a) National Film School (suggested) who do not have an automatic editing system yet.
- (b) Colin Wilkinson, Merseyside VCU, thought some backing could be found in his region.