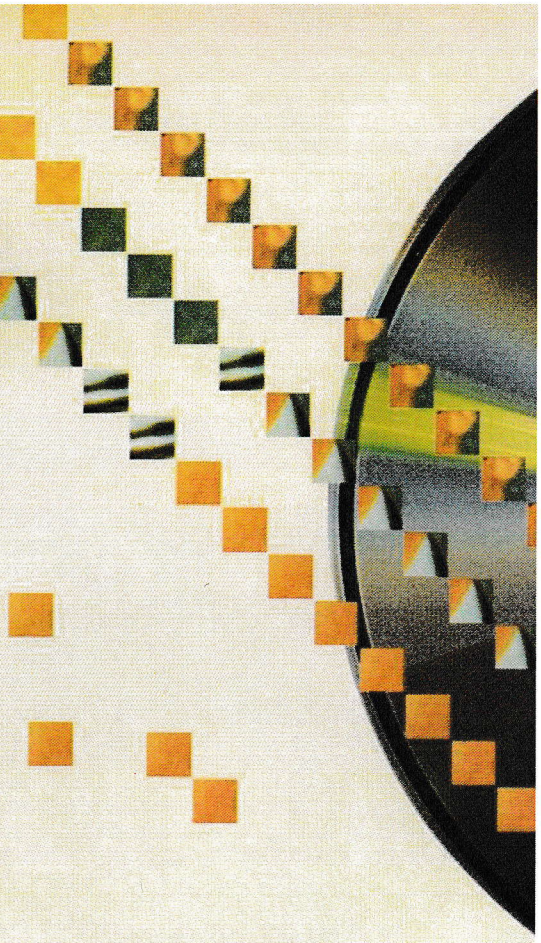
DIGITAL MASTERS

ANDY CLOUGH goes behind the scenes at the Philips Research Laboratories to meet the boffins who are pioneering the development of Video CD



Will Video CD be the next mass-market entertainment format to take the world by storm? That is the question on everybody's lips in the consumer electronics industry, and European and Japanese hardware manufacturers are queuing up to show off their latest prototypes.

But none of this would have happened if Philips hadn't made the impossible possible — by putting video onto a standard five inch compact disc. It is the work carried out by the Philips team at the company's research laboratories in Redhill, England that has finally made Video CD a commercial reality.

The buildings at Redhill may look like an old school science block, but the work that goes on within is groundbreaking stuff. The boffins here have worked on the development of some pretty successful products: colour television, cassette tape, audio compact disc and more recently CDi.

But what is really putting the Redhill team on the map is the work being done on the encoding of Video CD. Early films on CDi, which were encoded to the CDi-only Green Book standard, were of variable quality. Transferring film to CD is no simple task, as the guys at Philips will tell you. Much of the problem lies with the fact that the MPEG 1 (Motion Picture Experts Group) format used for Video CD requires 99 per cent of the data from the original video to be thrown out when a film is transferred to CD. Some deterioration in quality is therefore inevitable.

The boffins at Philips have spent many hours working out how to improve the encoding process. One of the first companies to become involved in the process, it has a head start over many of its rivals. Some of the best digital video transfers — such as "Top Gun" and "Star Trek VI" — were overseen by the Redhill team. Today, much of the day-to-day work of converting films on to disc takes place at Philips's dedicated Video CD plant at Hasselt, Belgium, but Redhill still works on pushing the limits of what can be achieved with digital conversion.

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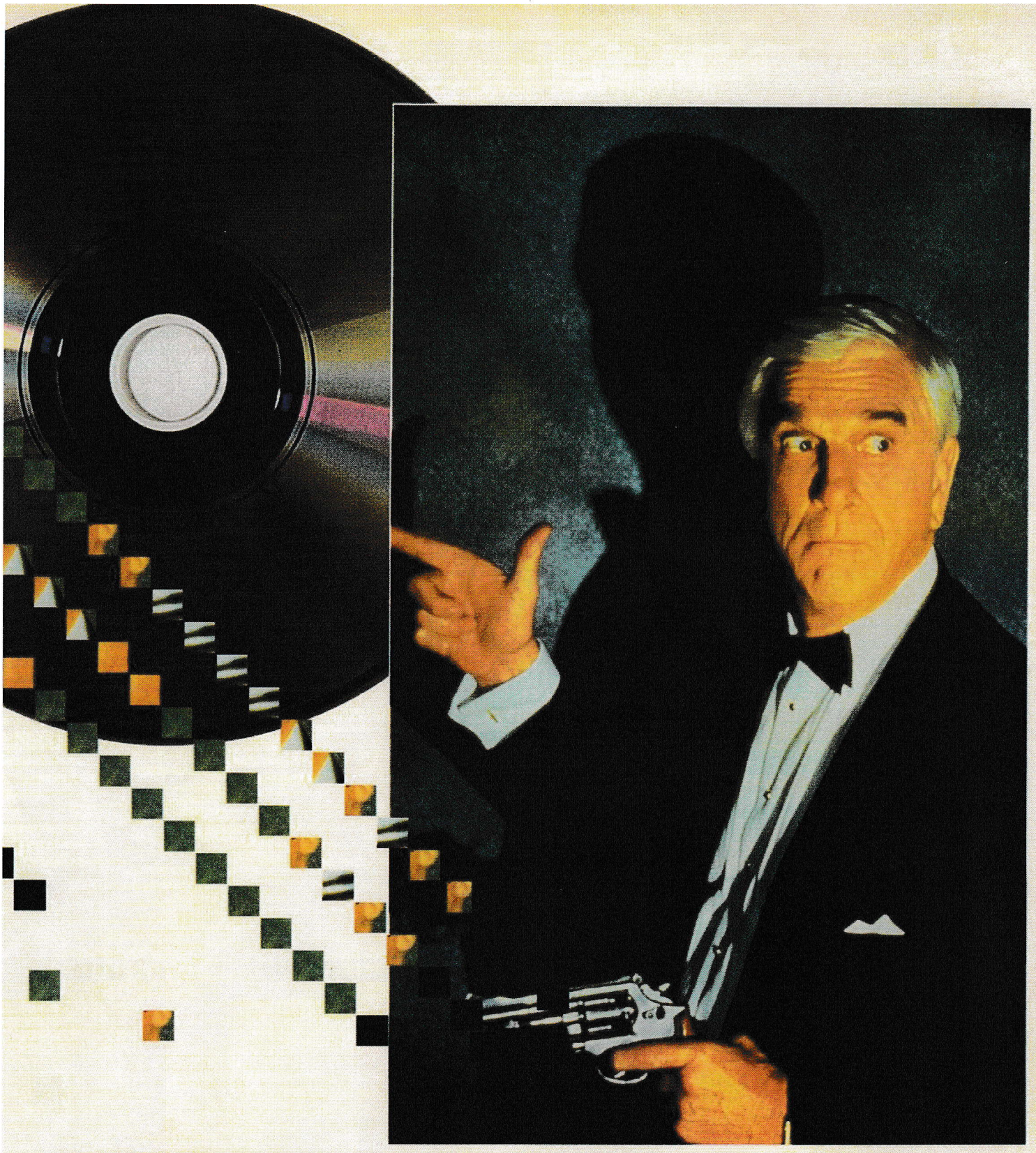
Ian Fagg, the studio manager at Redhill, explains: "It all depends on the quality of the original material you are given to work with. A D1 digital master tape is our preferred format. Remember, to get 74 minutes of video and sound onto a CD you have to lose 99 per cent of the original data. It is how you throw that 99 per cent of data away, and what you keep, that makes all the difference."

Fagg and his team have spent many frustrating hours trying to obtain the best quality source material from the Hollywood studios — not always with ease. It is very much a case of put rubbish in and you will get rubbish out. Often the assets required would be missing or stored in a less than perfect format, such as a D2 tape which has already been encoded for PAL or NTSC (the British and American broadcasting systems). D1, Digital Betacam or D5 tapes are still the best options, says Fagg.

The best mastering materials are D1 digital video tape for the visuals and Digital Audio Tape (DAT) for the soundtrack. D1 will produce a brighter, more colour-true result with fewer of the digital artefacts (or blocking) that are such a problem with Video CD. For example "Star Trek VI", which is one of the best-encoded films to date, was sourced from a D1.

"We have changed perceptions in Hollywood on what constitutes acceptable quality," says Fagg. ▶



ONE DISC OR TWO?

Current Video CDs require two or three discs for a full-length feature film. Following the announcement that the industry is working towards a new standard for high density Digital Video Discs (DVD) that will carry at least 135 minutes of film, what are the implications for MPEG 1 Video CD?

For a start, the new standard has not yet been set, which can be a lengthy process. In addition, there are no DVD high density disc players currently available.

Even if these are ready for production next year, they are likely to be considerably more expensive than existing Video CD compatible systems such as CDi. Sony and Philips's proposal for a high density disc emphasises the importance of backwards compatibility with MPEG 1 Video CD formats. Any new hardware would have to play existing audio and Video CD discs, say the two companies, and this is likely to be an important consideration in setting the new standard.

A true mass-market for DVD systems is still some way off.

Simon Turner (above left) and Ian Fagg (above right), the brains behind Video CD

"Many film studios now re-transfer masters onto D1." Once a suitable master has been obtained, the encoding process begins. The Philips Research Labs use a Silicon Graphics Onyx costing a cool $225,000. There has been much talk in recent months of "real-time" encoding, in which one minute of film takes one minute to encode. But Philips prefers to stick to a 1/40th real time encoding ratio which means each second of film takes 40 seconds to encode. Fagg admits real-time encoding is feasible, but that the quality will suffer. "Our encoder does much more work than it originally did — and does it better — but not faster. It is still a choice between fast and dirty and slow and clean."

One of the problems with MPEG is that it finds certain scenes difficult to handle. Lots of fast movement, such as car chases or panning across a rock stadium, are a perennial nightmare. Take a look at some of the independent Video CD titles that have been released over the past year, and you'll see what we mean. Rock concerts, in particular, can come out looking extremely murky.

A lot of the work at Redhill goes into cleaning up any problems once the first encoding has been done. It is not just a question of running the tape through the computer and leaving it at that. After the first encoding, certain scenes in a film may still not be quite right, so Fagg and his team will go through the entire film picking up on any problem areas. Difficult scenes can then be re-encoded with different settings. Usually, an encoded film is divided into 200 sequences of 30 seconds each so that any one sequence will take 20 minutes to re-encode if necessary.

Eliminating any glitches inevitably leads to some compromises. With MPEG, it is a question of opting for either a smoother, slightly softer picture (generally preferred for European titles) or a sharper image but with slightly more blocking (preferred in the US).

The audio is encoded separately at about 30 times real time. Audio will match what is on the master tape, so will be mono, stereo or Dolby Surround Sound depending on what's there.

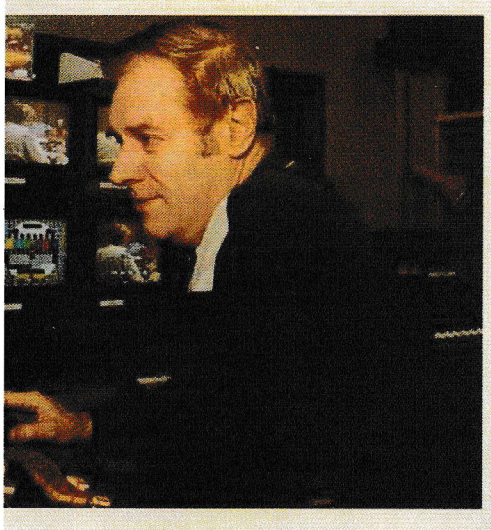
Once the encoding is complete, a WORM (Write Once Read Many) disc is built and checked to see that it plays back properly.

The WORM is then sent to the appropriate film studio for approval, a process that can take a while if the studio executives, the film's director — and possibly the stars in it — have to give the OK.

Getting approval, planning the marketing and distribution of the disc and its final manufacture often take far more time than the actual encoding process, which is why talk of "real-time" encoding is somewhat academic, says Fagg. The final Video CDs are pressed at one of five dedicated production lines at Hannover.

Macro-blocking: the most common fault with MPEG. Basically, the screen breaks up into 16 x 16 or 8 x 8 blocks, more commonly known as "jaggies", when the encoder runs out of the "bits" it needs to produce an acceptable image.

This attention to detail may seem pedantic, but Philips is acutely aware that the quality of the final film is what will make or break Video CD as a mass-market format. Already, some companies have jumped on the Video CD bandwagon and have produced discs that are, to say the least, less than perfect. May the perfectionists win.



Digital rain: this is general background instability. Small objects such as a tree can appear in one frame, disappear in the next, and then reappear several frames later in a slightly different position. Very confusing! But the boffins at Philips have now developed a way of keeping such movements to a minimum.

WHAT ABOUT WIDESCREEN?

So far only "Apocalypse Now" has been encoded to the widescreen format. Philips says it will consider releasing certain future films in the widescreen format where appropriate. But the company says consumer research has shown that the majority of home-based video viewers prefer the full-screen format to widescreen. Most future releases will therefore be full-screen, but Philips says it is sensitive to the benefits of widescreen for certain specific titles.

Mosquitoes: a heat-haze effect around certain moving on-screen objects.

MPEG 1 VERSUS MPEG 2

Will MPEG 2 be the solution to all MPEG 1's problems? Not necessarily, according to Simon Turner, head of Philips Interactive Media at Redhill Research Laboratories.

Turner is one of the people who invented CDi and is a member of the Motion Picture Experts Group that has set the MPEG 1 and MPEG 2 standards. As ever in the world of new technology, things are never just black and white.

"MPEG 2 isn't necessarily better than MPEG 1," says Turner. "MPEG 2 has been created mainly for broadcasters. If you are running video at over 4 megabits/second, then it is best to use MPEG 2. If running at less than that, you can use MPEG 1 or 2."

But hang on a minute. MPEG 1 has a resolution of 352 x 288 compared with the MPEG 2 spec of 720 x 576 which means MPEG 2 should give a much clearer and more detailed picture. So what's the problem?

Basically, the performance of both standards depends on the rate at which you feed them the data. Running MPEG 2 at, say, 1.5 to 2 megabits/second won't produce noticeably better quality than MPEG 1, says Turner. Run both standards at 3 to 4 megabits a second, and it's too close to call.

And to play an MPEG 2 disc requires a larger processor and at least 2MB of RAM, so the hardware would inevitably be much more expensive than existing MPEG 1 players, which require only 0.5 MB of RAM.

"The basic costs dictate that whatever the quality, MPEG 2 is not going to happen as a mass-consumer product for a very long time. MPEG 2 running at 8 megabits/second will produce a superb picture, but the cost of the decoder will increase dramatically," says Turner. "And MPEG 2 will NOT necessarily improve the speed/standard of games.

It would be better to use the extra RAM to improve the quality of games rather than the video."

Even if some companies do produce a consumer MPEG 2 player next year, it is likely to be very expensive. An MPEG 2 player at an affordable mass-market price is some way off.