the art of VIDEO MAGIC

John Fleming interviews BBC Electronic Effects Operator A.J. "Mitch" Mitchell, one of the only three Electronic Effects specialists in the world.

A lot has been written about special effects and almost all of it has been about film effects. But a totally different set of techniques are used in television, on shows like **Dr Who** and **Blake's 7**. Electronic effects use television technology, not film technology. At its simplest, it's the technology that puts pictures behind newsreaders – pictures which you couldn't see if you were in the studio. To find out how electronic technology is used in television fantasy shows, John Fleming went to BBC TV and talked to A.J. 'Mitch' Mitchell, one of the Corporation's three Video Effects men. There are none in ITV and no direct equivalents anywhere else in the world.

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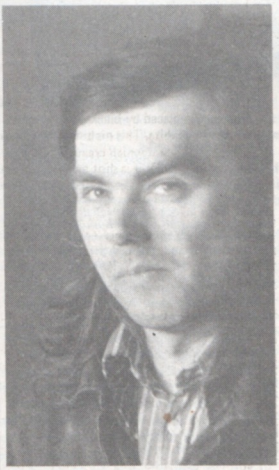
Mitch says he was "very lucky". He started by pulling cables and then drove camera cranes. All in all, he was an assistant on just under 300 shows and a cameraman on around 600. When he started at the BBC, there was a small group called Inlay Operators. These, basically, flicked a switch to 'inlay' pictures on captions – the process in black and white television of *electronically* cutting a hole in one picture and laying another picture in it.

Mitch worked as an Inlay Operator on the BBC's attachment scheme, under which you can do somebody else's job for short periods. "I did this three month attachment," he told me, "and it was total chaos. I did *[producer]* Barry Letts' **Dr Who**s, which were the first ones in colour, with a whole lot of electronic-type effects in them. I got quite interested and, in the end, did it for six months. The shows were really chaos because the inlay man was just an operator and he wasn't in charge. There was no specialist dealing with the photographic side of effects at all. I'd worked on shows which had over-run their allocated studio time because the effects hadn't been properly planned. During my six months, we unofficially started to plan them between us and things were actually beginning to work. But it was very frustrating and, at the end of the six months, I went back to the camera department. In 1970, I wrote a paper suggesting the BBC employ Special Effects Cameramen. Four years later, the job of



Electronic Effects Operator (EEO) appeared and I was offered one of the posts."

Since then, with the EEO's expertise and the sophistication of electronic equipment both growing all the time, the BBC's video effects have improved dramatically, although money is always a limiting factor.

The first season of **Blake's 7** was underbudgetted *[see interviews with producer David Maloney in* **Starburst 18** *and effects man Ian Scoones in* **Starburst 21***]*. At the end of the first series, David Maloney wanted to simplify the teleport technique because creating the effect was relatively time-consuming and therefore costly. But the effect was so popular with viewers, it was decided to make no change.

"The original concept at the start of the series," says Mitch, "was that they wanted to have a teleport system similar to **Star Trek**, but they didn't want the same effect because people would say they were copying **Star Trek**. The script editor *[Chris Boucher]* thought it would be useful to discriminate between when

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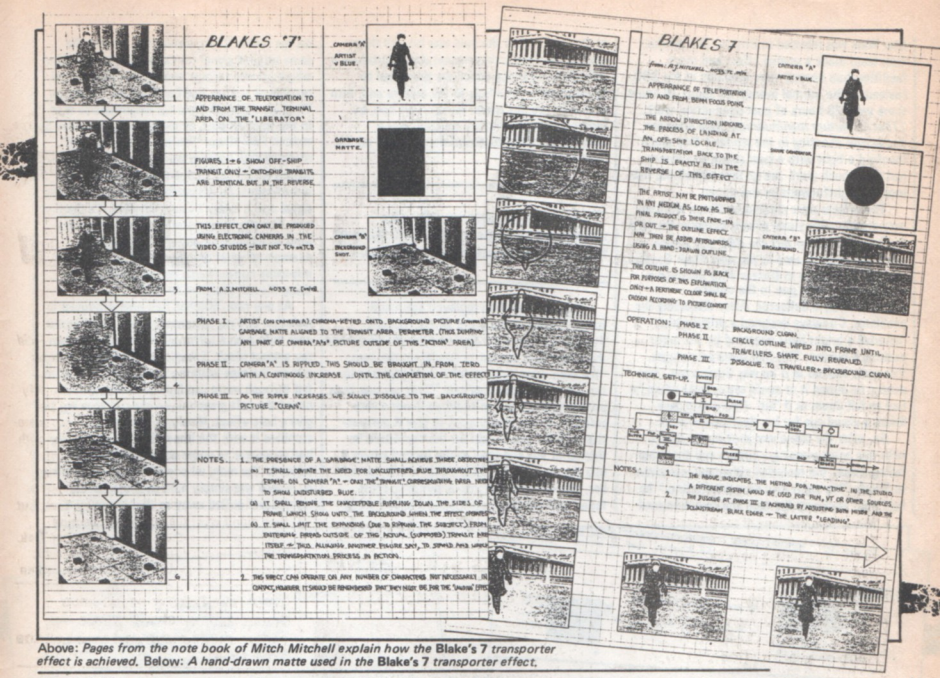
they were on the Liberator and when they weren't. So the brief was to produce an effect which was completely different from **Star Trek** *and* which was different on and off the Liberator. It meant a director could shoot a close-up of an actor teleporting and, because the effect was different, you could tell if he was on the Liberator or a Federation ship – because very often the interiors look alike when you're in close-up. The other part of my brief was that the effect had to be capable of working and looking the same on film, on pre-recorded video-tape and in the studio."

The end result is complicated but, when simplified, goes like this. The transporter in the Liberator uses chromakey (also known as colour separation overlay or CSO). This is similar to, but not the same as, the blue-screen matting technique used in feature films. Two pictures are combined and the second picture only "takes" on the parts of the first picture which are a particular colour – normally blue. For the Liberator transporter sequences, the actors stand in front of a blue screen with a camera looking at them. Another camera looks at the transporter set. The two pictures are then combined so that the actors appear to be in the set: the set is electronically 'matted' into the blue areas around the actors. When the first camera's picture is faded, the actors disappear and the transporter set is retained. While the actors are being faded out, an electronic ripple



Above: *Pages from the note book of Mitch Mitchell explain how the* **Blake's 7** *transporter effect is achieved.* Below: *A hand-drawn matte used in the* **Blake's 7** *transporter effect.*

effect is fed into their camera so that they appear to waver as they disappear.

"We had a problem with that effect on the last series," says Mitch, "because we moved to a studio with a new, modern type of camera. The new cameras have a safety circuit in them that looks for things going wrong – it shuts down if something looks like it's going wrong and might damage the camera. When we started to do this ripple effect, the cameras shut down because they thought the ripple was a fault. So now we have to disconnect some of the circuits when we do the effects in the studio. And this is not good because, if there were a real fault, the camera would blow up – as it did on one occasion."

"The *Blake's 7* brief was to produce a transporter effect which was completely different from *Star Trek* and which was different on and off the Liberator."

This is only the Liberator half of the transporter effect and, because it is always shot on the Liberator studio set, video effects can be used all the time. But when the crew transport onto or off a planet or another ship, the landing may be shot on film in a studio or video in a studio or film on location. This second transporter effect shows the actors appearing within a white line silhouette of their own shape. If the effect is shot on videotape, the actor stands in front of a blue background, his shape is electronically replaced by black and the blue is replaced by white. This picture is then fed into special equipment which creates a white outline. If the effect is shot on film, the white line silhouette has to be hand-drawn onto the picture.

Mitch explains: "We freeze-frame at the point they're going to disappear and we have a white light source with a sheet of tracing paper taped down to keep it in a fixed position. Then, with Indian ink, we draw round the shape of the actors. This is photographed by a camera and that silhouette is used to generate the pattern that you see surrounding them. But it's not that simple. You don't trace on a tv screen. You have to do it in front of a sort of rostrum camera which is a black and white television camera that looks in a mirror, horizontally, and there's a light box under it. You're looking over your shoulder at a monitor which is over to your right somewhere. So you're looking over the arm that you're drawing with. It's a technique that takes some time to learn: to look at the screen and not what you're drawing. As soon as you look at the drawing itself, you'll lose it."

Laser rays from guns are also hand-drawn and are always static – people don't move and shoot at the same time because that would involve drawing a separate ray on each frame of picture and there just is not the time or money available. In fact, few lasers appear in **Blake's 7**. The Liberator crew's gun are just internally-lit perspex tubes; when the light inside is switched on, the other actor falls down as if hit. The Federation guns are props built by the visual effects designers *[see interview in* **Starburst 20***]* which emit a puff of smoke; the person "hit" is wired up for a physical explosion, so no electronic effects are needed.

Doctor Who can sometimes be more complicated. In particular, there was *Underground*, the 4-part story which was screened at the time

Star Wars was released in Britain. The production team made a special effort and more facilities than normal were available at the BBC. Instead of the normal average of about 10 hours, there were 28 hours of post-production work. *[That is, picture manipulation done after the live-action shooting in the studio.]* One scene involved a fight with a laser shield and shows just how much work can go into something that looks straightforward on the screen.

The effects were created by Mitch working very closely with visual effects designer Richard Conway *[who later left the BBC and whose work can soon be seen in the new* **Flash Gordon** *movie]*. The scene in **Doctor Who** involved a shield, with a laser gun in the middle surrounded by a deflector. After discussing the problems, Conways designed a shield which included a bright light operated by the actor pushing a button. This had three advantages. The actor looked as if he was firing a gun. The person he aimed it at could see exactly when he had to fall down as if 'hit'. And it also gave Mitch a visual cue for his electronic effects.

So, after the scene was shot in the studio with one actor pressing a button and the other falling down, the recorded videotape was given to Mitch. "We went into post-production," he told me, "replayed the tape and freeze-framed at the point when the man was hit. We then used an electronic shape-generator to produce a soft diamond shape which we then used to electronically cut a hole in the picture and, into that hole, we put green. So what we had, by fading up and down very quickly, was a momentary green diamond-shaped flash on the man's body.

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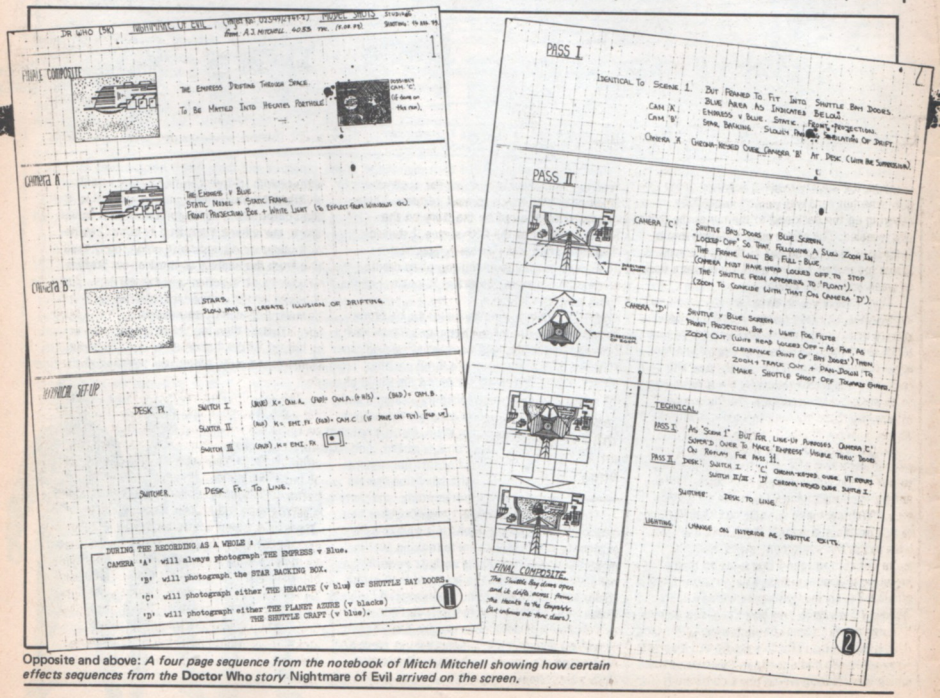
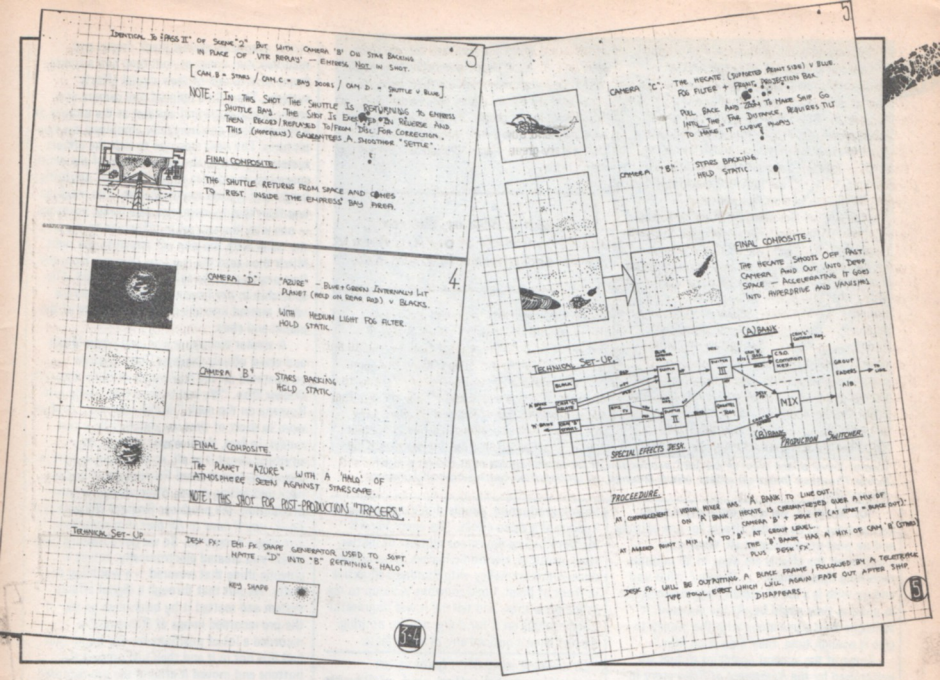
The tape was then replayed again and freeze-framed at the point where Richard Conway's bright light appeared on the shield and the green flash started to appear on the man. "We then drew a ray which would join one to the other," Mitch explained. "This ray was then put completely out-of-focus so it was a very soft line. It was also shaped to give it perspective – If the gun is near us, the ray would be thicker at our end than at the far end where it hits the man. We fed that signal which, remember, was out-of-focus into a 'dynamic cross-fader' and put black on the outside and green on the inside. Then, separately, we put the same original signal into an electronic machine which creates colours and we put blue on the outside of the ray itself and red on the inside. Then we adjusted them for brightness so that, in the thickest part, at the gun end, it would be redder. And it was 'tearing' *[ie flaring and shimmering]* because we were using a 'hard' switch which can't cope with things that are out-of-focus. So it's getting a soft out-of-focus signal and it doesn't know whether it's there or not. The electronics aren't quite sure, so it's kind of flashing on and off. It's a perfect example of what special effects are all about: mis-using conventional equipment for something it's not designed to do."

At any rate, Mitchell had now produced in isolation one ray comprising a shimmering red core with a blue surround. And another green ray against black. These rays had still not been put on the tape with the actors. The rays were fed through more machinery which superimposed the soft green ray on the red/blue ray to give a halo effect. Now was the time to combine it with the live-action scene. The ray had to appear to come out of the laser gun towards the man, who was stunned or killed by it. A card was simply held over the effects camera and pulled away so that the ray was



Opposite and above: *A four page sequence from the notebook of Mitch Mitchell showing how certain effects sequences from the* **Doctor Who** *story* Nightmare of Evil *arrived on the screen.*



revealed, apparently moving outwards from the gun. Another card was pushed in behind, covering up the back end of the ray as the front was revealed. The effect on screen was that a short laser burst came out of the gun, travelled across the screen, hit the man, there was a flash of green and he fell down.

This, believe me, is an extremely simplified explanation of a very complex and time-consuming process and the result was to create one single short burst of laser-fire. Every time the actor fired from a different position or was seen from a different camera-angle, the process had to be repeated from scratch. On the screen, effects like these are over in a second and the viewer is likely to take them for granted.

Another everyday and little-acknowledged part of electronic effects is finding something to put on the video-screens now commonplace among the control panels in **Blake's 7** and **Dr Who**. "We're actually running out of new things to put on those screens," Mitch told me. "We have to use the equipment that's available; we're not able to spend vast sums on manufacturing special equipment or renting it from outside. So, on the *Powerplay* episode of **Blake's 7** *[season 3]*, we had to fill five screens. We used an electronic character-generator called ANCHOR, which is BBC-designed and therefore comes free. We had a Riley shape-generator which was creating words like a continuous read-out from a computer. We had another shape-generator which created patterns. There was material required by the story on the fourth screen. For the fifth screen, I started fiddling around and eventually used the producer's ashtray stuck on top of an oscilloscope with a camera pointed at it, put out-of-focus and put through a machine that creates bright colours out of normal colours. It looked far better than any of the expensive things we'd brought in and that, actually, is what special effects is all about — improvisation.

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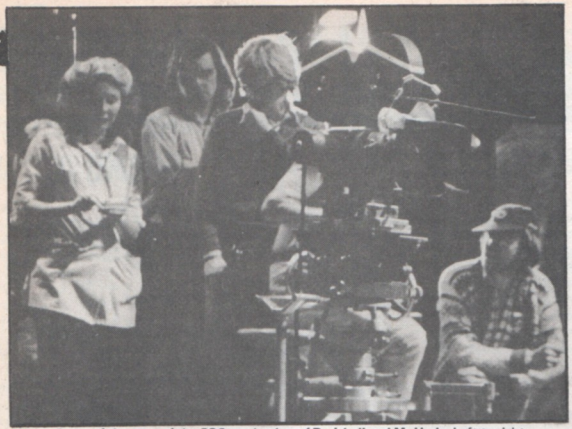
"I imagine most **Starburst** readers and amateur movie-makers think we have fantastic, expensive, amazing pieces of electronic equipment. Sometimes we do but in fact, professionally, most of it's held together with string and sticky tape. Amateurs will have their Canon or Bolex 8mm cameras covered with all sorts of extraordinary devices made for them by the manufacturers. But the cameras we use are built for strength, to go out in the rain, sit where there's explosions going off, to be used day in and day out. Our electronic cameras aren't switched off at all — they're left on all the time like computers. This equipment is built to last and to stand hard treatment. It doesn't come with many extras and there aren't many available from the makers, so most of our stuff is literally stuck together with camera tape. But, as it's all one-off, there's no need to build it in a permanent way. It's improvisation. Basically, a special effects man on photographic effects spends his whole life doing what an ordinary cameraman would spend his life trying not to do."

The BBC has three video effects men; ITV has none. So only a few prestigious productions ever have a specialist overseeing them. There is still a bias towards film effects on television, although Mitch believes electronic effects can be more flexible and, in many case, much better for television transmission. The problem is getting time and money. Because video effects have a bad reputation, they are only used on cheap productions. And because they are only used on cheap productions, they get a bad reputation. It's a vicious circle. Mitch says: "If it's a cheap production, they can only give 15 minutes for the matte shot. If it were film, they'd give a day and it would come out looking pretty good. But if you did a matte shot in a day on video, it would come out better.



Above: *Some of the crew of the BBC production of* **Dr Jekyll and Mr Hyde.** Left to right: *Sylvia Thornton (make-up artist), Mitch Mitchell, an unidentified camera-man and director Alistair Reid.*

"On **Blake's 7**, we were quite often given half an hour to do *all* the effects for one episode and no post-production at all. When you consider all the effects are done in 30 minutes recording time, I mean . . . *[laughs]* What you end up with is a lot of rushed, ragged things not as good as they could be. At the moment, if someone does come along with the money to give it enough time, they'll do it on film."

Some of the current problems of bias are epitomised by the *Nightmare of Eden* story in last season's **Doctor Who.** It was the first time in the history of the programme that all the model shots were done on videotape not fiim. Mitch doesn't think it was a great success, though. Originally, the effects were scheduled to be shot on 35mm film at Bray Studios. Shooting was to take four days with a special effects camera crew from the feature film industry. The **Doctor Who** producer wanted to try electronic effects and this was agreed by the BBC facilities department. Only later, close to shooting, was it discovered what the "swap" entailed. Instead of four 8-hour days of filming, the director was given 2½ hours in the video studio: the "standard exchange rate" between film and video. "So," says Mitch, "we ended up shooting all the models for the four 25-minute episodes of that story in 2½ hours and it's only the expertise of the cameramen that made it look as good as it did.

"People watch the news and current affairs programmes and they see chromakey that's slung together. A blue screen's stuck up which might have too little or too much light on it *[the exact shade of blue is critical]* and it might have a shadow on it and it was literally put up in 30 seconds. The whole thing's rushed like that and so you get people with huge blue halos and great black lines down their sides and video effects get a lousy name. But the thing is that, on the shows where it's good, nobody notices. If the effects do work and it's not a science-fiction production, people don't realise they're looking at a video effect. The opera *Verdi's Macbeth* had an enormous number of mattes, glass paintings, electronic mattes, giant scenes done with chromakey with hundreds of extras in front of them. I had someone walk up to me at the press show and tell me it was disgraceful I had a credit on it for doing next to nothing. He just hadn't noticed any of the effects.

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"And now you've got things like the Quantel 5000 machine, which is the beginning of digital video effects. You can enlarge the picture four times, infinitely zoom out so it goes into a dot and disappears, move the picture around, squeeze it, flip it, tumble it. These things would cost a fortune to do optically on film. One of the problems with video until about two years ago was that, unlike film, you never had the single frame of picture available to you. *[Videotape is a brown material like sound tape. The picture is not visible; it is electronically encoded onto the tape.]* All you could do was run it at full speed and see the picture. There was the video disc, which they use for action replays on sport, but they're very expensive machines and the BBC's one is basically given over to sport – it's very difficult to get time on it."

Recent developments have meant that new videotape machines with "digital frame stores" will display individual still frames from the moving picture which has been recorded. Once these frames are available to the effects man, he can manipulate them.

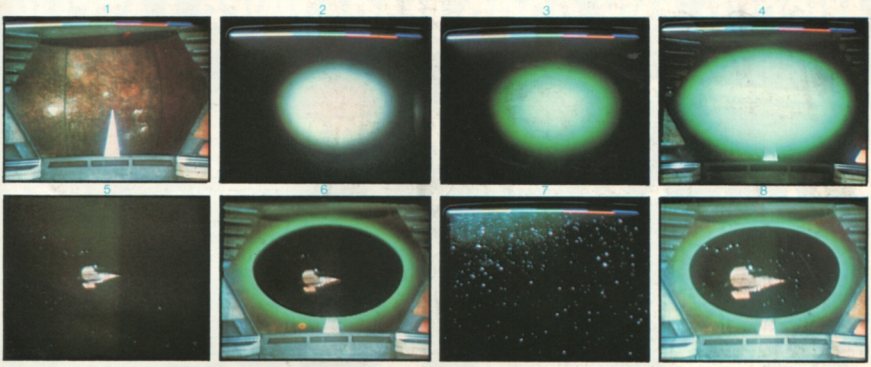
On the last season of **Blake's 7**, digital equipment was available on certain days. For one scene, Mitch and the crew shot a white model spaceship against black drapes and recorded that image so that they had a freeze-frame of it in one of their digital effects systems. They then pointed one camera at a starry background and another at the picture of a planet. They electronically combined the two pictures. The next step was to link the effects system containing the freeze-frame of the white spaceship to a device which "mattes" anything bright and ignores anything dark. The machine was then told to memorise two frame positions – one with the spaceship off-screen to the left; the other with the ship off-screen to the right. Mitch then told the machine to move from the first position to the second, which it did. The spaceship in the frozen frame floated across while matted into the combined picture of the planet and stars.

A similar technique was used when Mitch and visual effects designer Colin Mapson co-operated on the *Nightmare of Eden* story for **Doctor Who.** "We had to have a butterfly bite Romana on the neck," Mitch told me. "And we were so short of time we couldn't fly a real model. In fact, there wasn't time to do anything about it at all, so the scene as shot in the studio just showed Romana grasping her neck and falling down. When we got to post-production, the producer Graham Williams said *Look, you'll have to fix that shot somehow: it just doesn't stand up.* So we got a flashing light which was created electronically. It was a glowing thing that wavered – a wobbling dot, really. We put that through a digital effects system and matted it by brightness on top of the pre-recorded image of Romana. We recorded a lot of positions for the frame that had this dot in it and then just pressed the buttons and moved it around the pre-recorded image. We'd pre-determined the point where it hit her neck and just timed it so that the thing was in the right position at the right time."

That's an everyday complication of video life. More complicated still is Mitch's work on the new BBC **Dr Jekyll and Mr Hyde**, which combines film and video techniques. "We've shot most of the material for the transformation sequences on 35mm film," he told me. "That way, we got days and days to do it. Then we transferred it all onto video tape and did the effects using video technology. The thing is, if you don't know there's lots of video effects in the show, you won't realise. It is an expensive production and, although for once video effects were chosen, no-one'll realise they're watching video effects because the money's been spent well and they work."

Rounding off, I asked about the fourth season of **Blake's 7**, which is to be produced by long-time **Blake** director Vere Lorrimer. Mitch won't be working on it, but he will be working with ex-**Blake's 7** producer David Maloney on the BBC's new **Day of the Triffids.** "It was going to have visual effects by my old chum Ian Scoones," Mitch told me, "But he's left the BBC to do the **House of Hammer** series for ITV. So David Maloney's filched another **Blake's 7** man, Steve Drewitt, to do visual effects on the **Triffids.**"

It sounds as though it should be well-worth waiting for.



Above: *A series of photographs showing how the effect of the view screen aboard the Liberator is achieved.* **1.** *The camera shoots the blank screen on the Liberator bridge set.* **2.** *Then a "key" generator is used to produce an oval shape, white on black with softened edges.* **3.** *This image is fed into a "colouriser" which is set up for green and black.* **4.** *The result is matted into the blank view screen.* **5.** *Now a model space ship with a few stars is shot.* **6.** *The electronic "key" is then used to matte this model and the few stars into the view screen on the Liberator set (see 4). This time the equipment is adjusted to matte the image in with a hard edge.* **7.** *Because the image of the space ship had only a few stars, a caption showing more stars is shot.* **8.** *This image is matted into the screen over the previous composite to give the finished effect.*
Below: *Mayhem on the bridge of the Liberator. A spectacular display of physical effects.*