

Look! No film

Steve Shaw is currently working on the first fully digital feature film shot almost entirely on the Thomson Viper. Here he describes the workflow enabled by the camera in Filmstream RGB 4:4:4 mode.

A unique feature film project started principal photography in late December 2004, as a co-production between companies in the UK and Lithuania. *Silence Becomes You* is the first 100 per cent digital cinematography movie captured via the Thomson Viper camera in uncompressed FilmStream RGB 4:4:4 Log 2.37 operation, with all digital intermediate (DI) post-production performed via Quantel iQ, assisted by additional digital image processing systems for 3D and 2D vfx work.

This project came about because of the forward thinking of digital cinematography and DI post operation MotionFX. MotionFX invested in digital cinematography and DI equipment at its introduction to the market, with the purchase of a Viper camera and iQ in mid-2003.

Late in 2004 MotionFX partnered with my digital film consultancy, Digital Praxis, with the intention of developing a full digital cinematography feature, working in partnership with an existing production company. The idea was that, with the knowledge gained from this project, a true scene-to-screen digital film production and post-production operation could grow and develop.

A partnership is agreed

Production company Dragonfly Films was already in discussion with MotionFX. I had previously worked with Dragonfly Films writer and director Stephanie Sinclair on the Oscar-shortlisted short *The Dance of Shiva*, along with DP Jack Cardiff, who was also consultant on *Silence Becomes You*.



With an interesting script written, and time already spent on the treatment, *Silence Becomes You* was an obvious first choice for testing and proving the concept of scene-to-screen digital film. The story is a physiological thriller set in a rambling old manor house. This made the use of digital an easy option, as its main restriction at present is wider mobility, with the camera tethered to its uncompressed disc-based recording medium. However, with Flash memory-based recording in the form of camera packs on the horizon, the time was right for a leap of faith to demonstrate that the

basic technology and workflows were sound, in readiness for a sea-change in film production and post-production.

An agreement was reached whereby MotionFX would become co-producers with Dragonfly Films. In this way, it was able to assist in the film's production while taking on all post-production and managing all the digital technology.

Digital workflow

With agreements in place and workflow decided, MotionFX bought two more Viper FilmStream cameras, two extra S.two D.mag DFR digital film recorders with numerous additional D.mag packs,

Defying the weather, the crew films the main set in *Silence Becomes You*.



The equipment fitting neatly into the back of a vehicle.

and an A.dock backup and archive unit with Adic Scalar 24 LTO2 multiple tape Jukebox. A JVC HD digital projector was bought for immediate dailies review. It was our intention to load data into the off-line system during dailies review and archive backup. For post/DI, two more iQ systems were bought, along with three Digital Fusion 2D compositing stations.

Sister company Marina Studios in Carasco, northern Italy, became responsible for DI and audio post – to be performed in parallel with the on-line editing – in its THX certified 7.1 surround sound critical screening room, which uses a Barco DP100 2K digital cinema projector, calibrated via Kodak KDM LUTs, running directly from the Quantel iQ.

Production

The production workflow used two Viper cameras in uncompressed Log RGB 4:4:4 FilmStream mode, capturing a 2.37 image direct to their respective S.two DFRs. Being able to capture a 2.37 anamorphic image using spherical Zeiss DigiPrime lenses, while retaining the full resolution of the CCD sensor, is a real benefit of the Viper, producing stunning anamorphic images.

The S.twos were housed in

MotionFX-developed wheeled rigs for ease of mobility, complete with batteries and chargers for non-mains powered operation – especially useful for roving shots. A number of different Viper looms were used, depending on camera requirement: 10m to 40m multi-core for main set work, providing power and image paths, with a longer dual HD SDI cable and local battery packs for Steadicam and roving shots.

An AccuScene colour viewfinder was used on the 'B' camera, with an Astro combined waveform monitor and vectorscope used with the normal B&W viewfinder on 'A' camera. 'A' camera was able to monitor technical level accurately for main shots, while the AccuScene viewfinder provided level clip warnings and a cam op-friendly image. This is ideal for second unit work, which requires a more 'unstructured' approach to shooting – often just a two-person team operating at remote locations with a Viper and S.two in the back of a car, with a small monitor fed from the S.two's downconvert output. Mobility was accomplished by using large 24v dc battery packs capable of 3.5 hours continuous operation, which were also used to provide mains isolation when running on local supply.

The director and DP used a Sony 23in flat panel LCD monitor mounted in a flight case for on-set monitoring. The Astro waveform monitor was used for level checking. We did have a small technical problem with this monitor, so we used an Apple LCD display and Blackmagic HDlink converter for a couple of days.

It was interesting to see the difference: the Sony has built-in audio and an image that was more appealing to the DP and director, whereas the technical guys preferred the Apple/HDlink, especially its ability to run user-defined LUTs. This means the technical waveform monitoring can be performed off the raw camera signal, whereas image monitoring for DP and director is LUT-modified to look closer to the true final image. The Sony monitor's ability to run off 12v and 15.5v dc was a big help in remote locations – something not possible with the Apple/HDlink combination.

DP Arturo Smith also chose to look at the unmodified 'green' LOG image, in order to check the true level of shadow and highlight detail in the recorded image; the talent and director preferred an image closer to the graded final. There is work to go here, but there are possibilities for better interactive viewing, combined with raw data technical monitoring.

The 'A' camera's signal was controlled by Florian 'Flo' Rettich, who monitored image via the Astro for optimal signal levels, and controlled the S.two disc recorder via an Apple laptop. Flo is now the world's first DFT – digital film technician, and will have a film credit as such. When running A and B cameras on-set, both were connected to the monitoring station for quick signal checking of both setups. At other times the two cameras were run as 1st and 2nd unit cameras.

The S.two systems can also provide calibrated LUTs to show viewable images balanced for final projection cinematography, removing the LOG and green cast characteristics of the Viper – although, as mentioned, these LUTs were often disabled to enable monitoring of the full dynamic range.

For critical beauty shots, where light level wasn't an issue, MotionFX-

developed optical filters were used to balance the image colour characteristics prior to capture. This is a preferable method for colour balance, but it does reduce exposure by about a stop depending on the density of the filter used, which in turn depends on the colour temperature of the light.

A number of shots also required high speed capture, and we approached this in two ways. For dance and dream sequences we shot with the Viper set to capture 60fps progressive, which when played back at 24fps gives an ideal 2.5x slowdown. For true high-speed requirements we used the CineSpeed camera from Weinberger running at 500fps. This was especially useful for vfx shots, including flames and water, as well as a mermaid shot in a swimming pool. We also shot at 30fps for minor slow motion effects.

ND filters were used to help with camera depth of focus, enabling the cameras to run as wide open as possible. However, there was a discussion with the focus pullers, Uli Schmidt and Christine Wagner, about the preferred T-stop position for optimum focus, their preference being a maximum of T-1.8 for sharpness, although the rest of us preferred higher values for depth of field. I suspect the focus pullers just wanted to make their job easier!

Audio was recorded by Clive Copland on a DAT recorder, which was also connected directly to the S.two DFRs to provide in-sync audio with the images, with the audio contained within the image dpx file header. When reviewing shots and loading into the off-line system, the audio was always

immediately available and in-sync.

Timecode was provided from the audio deck to maintain locked reference between the master DAT audio and digital images. This worked like a dream, even when shooting two cameras simultaneously on the same shot.

Each evening the day's rushes were viewed on the JVC HD digital projector, providing immediate feedback. The playback was also used to feed images to the off-line system, which were loaded in real-time via its HD compression codecs. However, one overlooked problem was that, with no Flex file being generated automatically from the S.two systems, this automatic feed to the off-line system didn't really work, so a separate digitising station was set-up for manual data loading and shot logging via a third S.two DFR. This worked well, but S.two is now very aware of the batch loading requirement, and we have fingers crossed for a Flex file generation capability – or alternative batch load process – very soon.

After data capture into the off-line, uncompressed feeds were backed-up to the Adic LTO2 tape archive jukebox via the S.two's A.Dock backup system. The D.mags were then available for re-use on the next day's shooting. The Adic LTO2 generated two cloned tapes: a usable copy and safety, with checksum verification to ensure 100 per cent accurate dupes of the original data.

Timewise, digitisation to the off-line system was real-time, with each D.mag recording approximately 35 minutes of material, although manual logging added to the time taken. The archive function took around 400 minutes per D.mag to generate the main and safety backups.

This is 200 minutes more than it should be and was due to the two tape sets being made sequentially rather than simultaneously by the Adic, due to present limitations with the A.Dock software. This will soon be sorted, I'm told, as we had Steve Roach and Mike Morrison from S.two visit us on-set to see our workflow.

As an aside, discussions with the bonding company were not the issue many expected, as the safety measures standard with digital cinematography mean that possible data losses are very limited, with a single half hour S.two magazine the realistic worst case loss based on a catastrophic failure (dropping the magazine into a river, or some such). A lot less worrying than a lab failure while processing 35mm!

The use of 'dailies' review via digital projection is a major benefit, allowing the full crew to see the progress of the film. Having said that, the dailies review process became intermittent at best, mainly due to the length of days being worked, but partly due to the confidence the production team had in the quality of the images being captured. A very positive endorsement for digital cinematography.

We can happily delete those takes that are never going to be considered for on-line, such as fluffed lines, missed cues, bad focus pulls, etc, which betters the more traditional film-based dailies approach. Performing the off-line via compressed HD also helped, as the quality was far superior to the normal SD used on 35mm film projects.

Locking the two Vipers to timecode from the audio deck for synchronised recording was another first, and it

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worked flawlessly. And just to complete the list of firsts, the Viper was also used underwater to shoot part of a dream sequence involving a mermaid. A splash-pack was used, with the dual-link output and power running through waterproof connections.

Problems?

To say there were no problems during production would be a lie, but none of them were that serious or critical. Interestingly, it was the more traditional needs for off-line editing that caused the first production problem.

There had been initial confusion about the off-line workflow, with the kit specification initially being FCP, which then changed to Avid. The problem with Avid off-line systems is that they are poor at 24fps operation, being SD-based and requiring a 3-2 pull-up to change frame rate from 24 to 30. This means the final edit decision list (EDL) is not 100 per cent frame accurate.

The newer systems from Adobe and Apple can directly ingest 24fps HD material, using impressive compression codecs to provide true 24fps editing, with no frame timing issues. The Avid kit was therefore rejected and Adobe offered to supply a Premier Pro system in its place.

However, learning a new editing system from scratch in such a short timeframe is not a practical proposition, so we returned to our first choice of an Apple FCP system.

This confusion resulted in a two-week delay in initiating off-line. Luckily this hasn't affected anything long term, as the D.mags that weren't loaded into the off-line during this two-week delay were simply re-constituted later. With all this bleeding-edge technology being utilised for the first time on a major motion picture, it's interesting that the biggest problem was with the more traditional requirements of filmmaking.

The off-line team provided DVDs of the rushes and the growing edit so that production could see where additional pick-up and coverage shots were required (and also to help with continuity checking). The problem here was that, as FCP on a Mac uses Quicktime, it was not possible to generate 24fps DVDs, so 3-2 had to be implemented. If we had gone with the Adobe off-line system on a PC we could have generated WM9 24fps clips, which would have been ideal.

This checking of material highlights an area where the digital approach could further benefit the production operation, and we are now looking at

generating a simultaneous lower resolution copy of all material for on-set checking. A small converter providing a real-time firewire output from the video tap would be ideal, generating WM9 video clips, for example.

The first camera-based issue was bringing the Viper into a warm interior environment from the freezing outdoors. With too many shots and not enough time to do them, there was not enough acclimatisation time given to the camera, resulting in back-focus shifts during shooting, making the image appear slightly soft.

As it happens, these first interior scenes were to form part of a fantasy sequence, which was planned for post-production manipulation, so part of our job had been done for us. Lucky – but we allowed more acclimatisation time from that point onwards, as you would for any film camera when moving between a dry low-temperature external environment and a humid warm internal one.

It would also be fair to say that the tape-based archive operation was not initially as slick as it would later be. The S.two A.dock backup system, working with the dual tape drive Adic LTO2 writer, initially worked with only one tape drive, requiring each backup to be carried out twice, once for on-line use and the second for safety copy. This was exacerbated by a faulty tape drive within the Adic system. As this had not been planned for, we started to drop behind with archiving, filling up more D.mag disc packs than anticipated.

S.two was very supportive, providing an additional backup system while it sorted the various issues. Great support, and we soon caught up with archiving. We also had an AccuScene viewfinder fail to power-up, which was very quickly replaced by the manufacturer.

The various manufacturers took the opportunity to spend considerable time on-set, observing their products being used in a live environment. This included Thomson coming over en masse to see our workflow and show us a non-working prototype of the soon-to-be released Venom Flash Pack. Very interesting.

Another problem was to do with the amazing resolution of the capture

medium. During the first few days of shooting there were issues with skin textures seen on-screen. The face powder being used was showing up on the final image – something not seen when shooting 35mm film. The solution was to use oil-based face creams that produced a smoother finish. A fantastic problem to have.

There was a final problem with timecode, in that for reasons not worth going into, the master timecode source was initially re-set to zero hours each day, rather than increasing an hour for each day. This resulted in multiple timecode values existing within some D.mags – something we will need to be aware of when performing the on-line from the off-line EDL. Not a major problem, and something we corrected half way through the 39-day shoot.

It was probably the sound department that had the most issues with the digital film equipment, as the fans in the S.two – and to a lesser extent the Viper cameras – are rather noisy when recording low-level dialogue. The camera fans can be shut down, but this has to be carried out via the operational menus, and so is not really practical, while the S.two DFR fans cannot presently be shut down at all.

To overcome this, the DFR units were positioned away from the set as much as possible, while the camera fans never really caused too much concern. In the future, S.two intends to provide a silent mode for the DFR, which will shut down the fans when the system is in record mode. I'm also hopeful that Thomson will do the same with Viper.

Production conclusions

The production phase of the project has proved the validity of digital cinematography, without serious problems being encountered. The equipment, including Viper cameras, S.two D.mags and operators, worked at -14degC without problem, got bounced around in the back of some very rickety old cars for 2nd unit work, were set-up in the middle of a wood in two feet of snow, got hooked to the back of a low-loader for through-the-windscreen two-shots, and in all cases performed flawlessly. We ran on 12v and 24v dc, local mains and



THE CINEMATOGRAPHER'S VIEW

Cinematographer Arturo Smith was shooting digital using Sony Cinealta over four years ago. *Silence Becomes You* is his first feature using the Viper. "The Viper in this configuration is the first time digital can really rival film," he says. "Once a couple of Viper films come out, people are going to get the message." He acknowledges that lighting is a little more demanding and "a lot less forgiving at highlight level"; however, set against this "it is a lot easier to monitor and make changes – like having your telecine in front of you while you shoot." Speed of course, is a major advantage – "you don't even have to shuttle back to review the shot as you do with tape, you get instant access." But there are downsides: "I used to look forward to the little breaks – whether it's when tape is being shuttled or film being loaded and the camera rethreaded. But with the Viper, I hardly get a break at all!" As for the future, things can only get better. "I think Vision 2 is about as far as Kodak can go for a while with film. On the other hand, digital can only get better. Rather than recording 2k, as at present, there is already talk of 4k CMOS chips, and I've even seen a paper on 8k chips!"

production generator power, even suffering floating earth problems when on local power, but all without failure or error.

The immediacy of the production workflow was praised by all involved, while the images generated, even before post-production colour correction and viewed via basic LUTs, were universally classed as stunning.

In total there will be in the order of 25TB of footage, amounting to over 60 D.mags filled throughout the production phase – over 33 hours of material. This is a shooting ratio of about 18:1, and the equivalent of 180,000 feet of 35mm film. All backed up onto 240 individual LTO2 tapes, 120 per copy.

This is a good example of the cost benefits of shooting digitally. For any independent film production running a relatively small budget, as with *Silence Becomes You*, it would be impossible to shoot that much 35mm film. Even with a relatively good lab deal the cost is going to be around 80p a foot for the negative film stock, processing and telecine to beta tape for off-line, with film dailies, transportation and risk in transit insurance being extra. The likely total makes the traditional approach cost a minimum of £150K.

Going the digital cinematography

route costs an average of £35 per minute of material, making a total of £70K. For independent filmmaking this is a significant difference. And that doesn't take into account the benefits of immediacy, interactivity, short decision-making timescales and full quality dailies.

Digital cinematography works, and works well. We expected far more problems than we encountered and were amazed by the ease of the production process. We have ideas for improving the process even further, as outlined above, and when we start our second digital cinematography feature in April we will be even slicker. There's no looking back from this point.

Post-production

Post-production began during the production phase, with LTO2 tapes being sent back to MotionFX's UK operation for vfx and 3D work to begin, with the off-line editing being performed on location.

As this is being written (early February), we are nearing the end of the production phase, with main post-production just beginning. It will be interesting to see if the fluid workflow attained so far can be maintained through to the end of production, and into full post-production. Experience

Taking the Viper out for a swim for *Silence Becomes You's* mermaid sequence.



Steve Shaw, director of Digital Praxis, is a technologist, involved in building digital intermediate business operations, as well as an experienced hands-on creative. His credits include numerous films and ads, from Elizabeth to Piazza Delle Cinque Lune. He has been technical director at Cintel, MD of Postware Ltd, MD of Soho-based visual effects company Men In White Coats and marketing manager at Quantel. Digital Praxis provides front-line support for companies operating in the high technology arena of digital imaging within the creative film and video marketplace. www.digitalpraxis.net



suggests it can, and we foresee no issues with the on-line, DI and vfx post.

The plan for post is straightforward, with the same DI workflow as used for 35mm material scanned into digital. However, with digital cinematography the workflow is even simpler, as the transfer of image data throughout the pipeline is very straightforward.

The off-line EDL will be used to autoconform from the archived data tapes, extracting the selected shots into a Quantel iQ via an EDL-based pull list. The extraction from the archive tapes will be via a 10TB NAS disc system used as a buffer store working in the background to the main iQ operation (via a Gigabit Ethernet network with

frame transfer rates close to real time). The beauty of the iQ approach is that we can initiate the post-production vfx and grading work as the material is being ingested – no waiting for one process to finish before another can begin. This is a major benefit in reducing timescales and keeping costs low.

When the film is fully loaded into the iQ and autoconformed via the off-line EDL, it will be split-screen checked against the off-line video to ensure no EDL errors. At this stage any editorial alterations can be made, based on seeing the edit in real-time on a large projection screen.

The vfx shots will already have been sent to the assist workstations for processing, including the new Digital Fusion systems and 5D Cyborgs and Alias Maya 3D. They will be dropped back into the on-line edit as available, replacing the initial background plate loaded during the autoconform. This means we can use the background plate to set-up and grade or pan and scan before the vfx work is complete. This will be carried out at MotionFX's London HQ, up to the point where the film is complete except for the final grade. The final on-line, with vfx shots correctly placed and a preliminary grade, will then be relocated to Marina Studios in Carasco, northern Italy for the final DI grade – using Marina's critical digital screening room – and to link with its audio post-production.

You might ask why relocate just for the final grade? The answer is simple. Because we can! Given the choice of a THX certified 7.1 critical screening room situated on the Italian Riviera, with great beachside hotels and restaurants, and cheap flights into Genoa, what

would you choose?

Marina Studios will also be performing the audio pre-mix and final mix on the project, working from the on-set captured audio and later ADR performed in the UK. With the toys at their disposal, the sound will be fantastic, matching the glorious images generated by Stephanie's set design and costumes, as well as Lithuania's amazing scenery, captured via Arturo's cinematography.

The final film will fall out of post-production before the end of March, complete and finalised. The director's cut will follow, and will be available shortly thereafter. Timescales are easy to compress when all the original digital information is so easily available. You want to make a change – it's made. No way it could be that easy with the traditional film approach. Hunting through reels of negative to find and scan an alternate shot is something you can only do in the off-line process. We can do it on-line too. How cool is that?

- MotionFX is currently working on three feature film projects, one of which is *Silence Becomes You*, the other two being more traditional 35mm shot DI projects. As a follow-on to this full digital film project, MotionFX will be holding a selection of workshops and private seminars for DPs, directors and producers who wish to learn more about digital cinematography at this level, specifically using the Viper in uncompressed Film Stream mode with iQ-based post-production. For more information, please contact MotionFX group sales manager Justin Lanchbury by email on justin@motionfx.co.uk, or John O'Quigley, operations manager, on john@motionfx.co.uk.

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