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Delivering Digital Film

A change in the stars

Geoff Boyle visits the set of David Fincher's upcoming movie, *Zodiac*, on which he uses a complete data workflow for acquisition and post, shooting on Grass Valley Viper cameras and S.two DFRs.

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The uncorrected green raw image from the Viper.



Colour-corrected to compensate. Pics courtesy D Fincher.

There are a few pivotal moments in the history of motion pictures, starting with the breaking of The Motion Picture Patents Company in 1915, which directly lead to the foundation of Hollywood. The other important events are:

- The introduction of sound in 1927;
- The introduction of 3-strip Technicolor in the mid-30s;
- The introduction of Widescreen with *The Robe* in 1953;
- Eastman Color negative film in the mid-50s;
- In the mid-70s both Panavision and Arri launched lightweight 35mm sync cameras;
- The first major use of DI for an entire film with *Pleasantville* in 1998;
- 2006: the first major Hollywood film to be shot and captured using uncompressed 4:4:4 full-range RGB,

David Fincher's new movie *Zodiac* is not the first film to be shot and captured using uncompressed 4:4:4 full-range RGB; it's not even the first film to be originated totally digitally in full bandwidth uncompressed: *Silence Becomes You* and *Le Poulain* came first. But it is the first major Hollywood movie with a serious (\$85 million) budget. This makes it a film that will be noticed and have an effect on the way that other majors make movies.

People have argued that *Collateral*, *Miami Vice*, *Superman Returns*, *Flyboys* or even the recent *Star Wars* films should take the title of first fully digital film, but all of those films either used a fairly conventional video approach or recorded to compressed tape.

David Fincher started shooting *Zodiac* in September 2005 with DP Harris Savides. From the beginning, Fincher intended it to be an all-digital totally uncompressed movie. He had experience of this approach from his commercials work, having already shot many spots this way, including those for Lexus, Heineken and Motorola.

I saw the Heineken ad at the Odeon Leicester Square on the biggest screen and didn't realise that it was shot digitally. Now at this point you should bear in mind that I'm the guy who shot the Viper launch footage at the 2002 NAB show; I also shot the footage that was shown at the Cannes Film Festival in the same year and I've shot regularly with it since. If I can't tell, who can!? I also really like the subtle tonal range of the ad that Fincher shot for the Motorola Pebl.

So, he had the background, but could he deal with the technology for an entire film? Was it reliable enough and would the studios accept it? Allegedly, he offered to personally indemnify the studio against any costs incurred by equipment failure. It would seem that the offer alone was enough.

As Fincher said: "If you have a fucking clue and a passion, people will get out of your way because people want someone to follow." Well, I think they'll certainly be following him in the way he's shooting *Zodiac*.

Fincher's background at ILM in effects has to help, as does his desire to constantly push filming technology to its limits. From his use, with Darius Khonji, of bleach bypass for *Se7en* to create a dark and hostile environment, to his use of pre-visualisation, motion control and computer-generated images in *Panic Room*, he has always been at the edge of what is possible.

Now, with his approach to *Zodiac*, he goes one step further. The movie revolves around a serial killer known as 'the Zodiac' who operated in San Francisco during the late 1960s. Leaving several victims in his wake and taunting police with letters written to the San Francisco Chronicle and other newspapers, the Zodiac was never officially caught. The film tells the story of the killings, still one of San Francisco's most infamous unsolved crimes, and of the four men whose lives and careers were built and destroyed around the hunt for the killer.

Mark Ruffalo plays Dave Toschi, the San Francisco detective who led the investigation, and Anthony Edwards plays his partner Bill Armstrong. Jake Gyllenhaal plays Robert Graysmith, a San Francisco Chronicle cartoonist and later author of two books about the Zodiac, on which the film was based. Robert Downey Jr plays journalist Paul Avery and Gary Oldman stars as Melvin Belli, a lawyer who was contacted by the Zodiac.

The movie has been shot as much as possible on original locations and uses the police officers and others involved as on-set advisors. When I visited the set, they were shooting a night scene where one of the victims is found in a car. Fincher was asking one of the officers who was actually on the scene of the real crime if they would be smoking at the crime scene or not. He was determined that it would be accurate.

"People will say, 'there are a million ways to shoot a scene,' but I don't think so," says Fincher, "I think there're two, maybe. And the other one is wrong."

The science bit

Now, as they say in the shampoo ads, for the science bit. The film is being shot with two GVG Viper cameras that have been supplied by Camera House in LA. They're being used with Zeiss DigiPrimes. Camera House has modified the cameras with additional mounting points and custom accessories. Both cameras are being recorded to S.two – a portable hard disk-based recording system – with both recorders mounted on a cart designed by Camera House. The cart also carries two 8in TFT monitors with waveform facilities and a Lockit timecode system. The Lockit T/C locks together the two cameras and the Aaton Cantar audio recorder, while audio is also fed direct to the digital field recorders (DFRs) for sync dailies.

S.two has also made some very simple remote controls for the DFRs, with big red and green buttons for record and playback. I like to think that this simple control was inspired by my call to Steve Roach of S.two while I was shooting the IBC launch material for Sky HD and was having a few problems with the Pocket PC-based controllers of the time. I doubt he wanted a second call with screamed obscenities waking him up in the early hours .

At the start of each take a computer-generated slate is automatically inserted, so there is no need for a clapperboard. There is also a tail slate that lasts for five frames and shows visually all the content of the metadata that is embedded in every frame.

Monitoring

There are twin 23in monitors for the use of the director and DP, and these have a LUT applied so that they are not looking at the flat green raw images produced by the Viper. Details of which LUT is being used is also recorded in the metadata so that the editor knows what to apply in the cut. Of course, the look applied affects only the monitoring, and all recording is done with totally RAW data. Interestingly, there has been no change in the crew size; the role of the video assist operator has been dropped and the data capture technician has replaced them. This means that Fincher can get replays of takes at full resolution immediately and can delete takes he is unhappy with as he goes. As he shoots a lot of takes of every scene, this has proved to be very useful.

"Directing isn't about drawing a neat little picture and showing it to the cameraman," says Fincher. "I didn't want to go to film school. I didn't know what the point was. The fact is, you don't know what directing is until the sun is setting and you've got to get five shots and you're only going to get two... that's the job. That's what it is.

"Doing cool stuff like designing shots is one per cent of your life. The other 99 per cent is holding everything together while there's total fucking chaos, maximising the amount of hours that you have in order to get stuff, being able to work on your toes. It's not all about going – [Fincher frames a shot with his hands] – 'we'll do this, and then we'll do that.' Well, now do it with a teamsters strike, with 150 people who are exhausted, who think that everything you're doing is, you know, gilding a lily – 'You don't need that shot.' I love it when people say that." Any system that simplifies his life and gives him more choice is very welcome.

Wireless access

The camera department has wireless access to the full-res DPX files saved by the DFR operator, and can download reference frames for shot matching. As these are stored on a laptop on the DFR cart, frames from the entire shoot so far are available at all times.

At the end of a shooting day, the D.Mags used by the DFR are taken to LA post house Rock Paper Scissors to be copied and backed up. These D.Mags are immediately transferred to Apple X-Raid storage as well as to two LTO3 uncompressed data tape units, thus creating two tape back-ups of the material on the X-Raid. At this time they also make a Quicktime copy using the DVCPPro-HD codec at 1080i for the editor Angus Wall, who is using Final Cut Pro to edit the movie.

Interestingly, S.Two has limited the record capacity of its D.Mags to 33 minutes so that each mag can be copied to a single LTO3 tape. I loved the fact that Angus is actually using a huge plasma screen as his main monitor so that he can get a feel for what it will look like on a big screen.

The look

So what does it look like? What I saw looked like a David Fincher movie. I wasn't aware of it being shot on any different medium. Harris Savides the DP isn't changing the look he normally uses, and he likes to work in the dark areas of a scene. I saw a scene that Harris had been worried about because he'd gone about as dark as he could. But as it involved a silhouette it fitted in perfectly with the Fincher style.

So where do movies go from here? Well, with the introduction of the Arri D20 and the recently added LOG capability, we now have two cameras capable of working in uncompressed 4:4:4 full-range RGB, as long as you record to a disk-based system such as the S.two, but why on earth would you want to do anything else? Why tie yourselves to the limitations imposed by TV and video?

Think about it as the same revolution that has happened in stills. Who shoots film when really good digital cameras are available? The quality of digital stills matches that of film. You have far more control over the image and also the ability to see it instantly and decide whether you need to shoot another. You can load the images into your computer and very easily manipulate them so they look more how you wanted them. You can afford to shoot a lot more frames as cost is no longer an issue.

But the main advantage is the increase of choice you have shooting stills this way. And finally we are able to apply the digital gains that are available to people working in stills to the moving picture business. So next time you have a project, it's worth considering the 4.4.4 full-range RGB route, because, as the ad I've already quoted says, "you're worth it".

Box copy

How data acquisition works

The Viper records in uncompressed Filmstream mode to remote controlled S.two digital film recorders, with footage transferred to D.Mags. Audio is recorded to an Aaton Cantar-X audio recorder. Footage is monitored by the director and cinematographer on 23in screens with a monitoring-only LUT applied to compensate for the low contrast and green cast of the RAW Viper signal. The post workflow for dailies is shown below. The movie is being edited on Final Cut Pro, with transferring to Xsans and archiving on LTO3 tapes, a further QT file using DVC-Pro-HD is made for editing. With this datacentric set-up, even the clapperboards are computer generated, with the end slate containing important metadata.

Box copy

Handling the post-production process

Andreas Wacker, who designed the workflow and database for handling the 18 million+ files and respective metadata for Zodiac, outlines the workflow handled by Rock Paper Scissors.

Zodiac was shot on the Grass Valley Viper. The S.two system stores the camera images as DPX files on D.Mags. These get backed up to LTO3 tape and copied for further processing on to the Rock Paper Scissors' (RPS) Xsan. We handle the post shoot dataflow as well as the editorial for the movie. Our goal was to keep the data pure.

During ingestion into the RPS system, the data files get verified against their LTO equivalent for safety and checked for time code jumps and other inconsistencies. DPX files can contain meta information in their header section. This, together with the D.Mag shoot information, gets converted into the RPS database. Script notes from the shoot are also added. This web-accessible database becomes the main information hub for all movie scene files.

From the DPX files RPS creates Quicktime movies for editing and dailies. The web-based dailies PIX system reads the RPS metadata automatically and distributes access to all involved parties. Finally, RPS adds the audio from the shoot and supplies the scenes to the editorial system.

The team of assistants at RPS, namely Wyatt Jones, Pete Warren, Brian Ufberg and Brad Waskewich, pushed an incredible amount of data during this production. They made sure we didn't lose a frame. They also kept pace with production, a commendable task for a job of this size. They also fixed any errors in data entry from the set, allowing only clean information to enter the system. A total of 18,220,156 DPX files have to be processed in total. The work schedule and volume of work was entirely dictated by the demands of the shoot. Joe Wolcott engineered the physical infrastructure of the system.

The implementation was based on commodity hardware and software wherever possible. An Apple Xsan stores the data and Final Cut Pro is being used for editing, while Shake is handling the downconversion. We have 25TB of online storage, six G5s, one Xserve render node and four Mac Minis. I benchmarked the Xserve and found that two Mac Minis gave us the equivalent render power of one Xserve, which proved to be a big cost saving. Custom RPS software creates the bridges between different software and defines the production database.

There was no precedence for this workflow. Movie production is operating on a 'do or die' paradigm on a daily basis. The concept of building simple yet reliable modules proved to be very helpful. These simple software atoms often do only one task, but do it very well. While broad concepts, such as "let's make our data secure" and "it would be nice to have dailies", were clear beforehand, the actual needs, schedule and amount of data could not be predicted. With this modular approach, we were able to retool and reconfigure along the needs of each shoot day, while maintaining a reliable and predictable output.

More than 60 per cent of the RPS software development happened after the first shoot day in order to optimize tools and modules to the needs of the production. It is worth mentioning that the data sets of the first day stayed compatible to the those of the last day. However, over the same time period the throughput of the system more than doubled.



Geoff Boyle

Reel Show cinematography editor Geoff Boyle's recent feature films as director of photography include *The Mutant Chronicles*, *Dark Country* and, currently, *Street Fighter 2*. He received his first camera, a Brownie 127, when he was eight. From then on the future was clear. After art school in the late 60s, he worked as a

stills assistant. One day he was asked if he knew anyone who could film a concert. Of course he did! He moved into film and shot documentaries for TV, 10 years or so of 20/20 for ABC and a lot of music videos. In 1985 he shot a 'making of' about the Pirelli calendar. Terence Donovan liked the way he lit and asked him if he shot commercials. From 1990 to 2005, he has shot almost entirely commercials, with occasional sidetrips into drama, a short he shot – About A Girl – winning a BAFTA in 2001. He also shot special effects on Enemy at the Gates, won the SMPTE Eastman Gold medal in 2000 and was made a fellow of the BKSTS that year. He started the cinematography mailing list (CML) in 1996 with 60 members. It now has over 3,000 members in 148 countries and is acknowledged as the pre-eminent internet site for cinematography.