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# A Producers Guide To The Digital Cinema Tsunami

## Getting Your Feet Wet

By Michael Carn

*Michael Carn covers the basics of a RAW digital cinema workflow and its implications for feature film and television production budgets.*

### 1. A new approach to recording images.

Over the past eight years, digital SLR cameras have replaced film SLR cameras as the standard for the professional photographer, and in large measure for the average consumer as well. Indeed most still camera manufacturers have either massively reduced their production of film cameras or stopped producing them all together. This has been driven by advances in digital technology, price, and a desire for a simple workflow that views and manipulates images of the highest quality.

However, many of these advances in digital stills technology have not transferred across to motion picture or video technologies yet. While the larger players in

the professional video market have used existing video technology to develop cinestyle cameras, these products have not yet become a replacement for film due to quality, workflow and/or cost factors.

Recently, smaller, more flexible companies have spearheaded the adaptation of digital SLR technology for motion pictures. This has been made possible due to the massive manufacturing base for the stills cameras and advances in computer technologies.

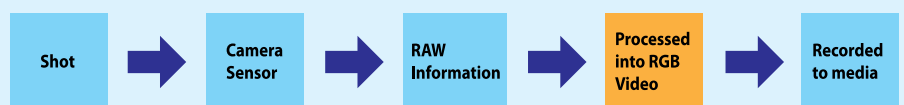
This new approach is not video based, but uses the flexible "RAW" format (until recently found predominantly in digital SLRs) as a replacement for film negative.

### 2. The RAW file format.

All video cameras process their sensor information into formats where 'What you see is what you get'. The camera changes the data from the sensor; it's colour,

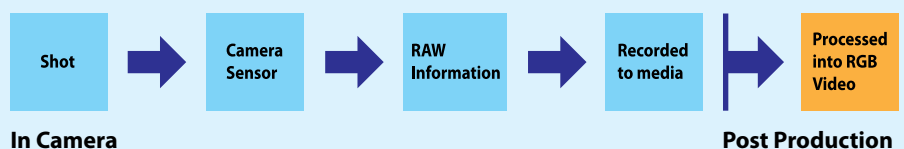
sharpness and dynamic range, to make the image look better directly out of the camera.

#### Traditional Video Camera



#### RAW Camera

The RAW cameras simply take the video processing out of the camera, leaving it for the post workflow.



### **3. Adaption of RAW technologies for moving images.**

The standard video camera '3-chip' sensor design limits the upper size of image sensors (due to the physical space required by three separate sensors and a prism to link them), whereas the simpler optical path in single-sensor designs create far fewer restrictions. This enables these cameras to use much larger S35mm-sized sensors, which can provide greater image detail and less noise.

Because these cameras record RAW data directly from their sensors without any processing, they retain valuable information that can be used for special effects and grading. RAW formats are non-destructive which means that changes to RAW footage are contained in reference files (i.e. the original footage is not actually modified).

To be able to work with RAW data the camera applies 'looks'. These are pre-grades that allow monitoring of the image on set. These 'looks'

are not 'baked in' as with video, but are non-destructive and therefore can be changed at any time. Capturing RAW allows the maximum image quality to pass through the post production pipeline.

This new approach is proving very successful and there are an increasing number of RAW cameras in the Digital Cinema market, including; Dasla's 4K Origin, Silicon Imaging's SI-2K, Red Digital Cinema's Red One and Arri's D-21. All of these cameras have different workflows and associated costs, but all use RAW as their primary capture format.

A RAW format, Jpeg2000, is the standard set for Theatrical Digital Projection. Just as film has been the primary capture and distribution medium, I expect that RAW will become its equivalent in the digital world.

### **4. RAW workflow in practice: Red One.**

The Red Digital Cinema Company is one of the smaller, more flexible players that have emerged over the last few years. As of June 2008 they have delivered over 2000 of their Red One cameras worldwide.

The rapid uptake of the camera has been due to several factors:

1. Price point. The camera body of the Red One sells for US\$17,500, and a full shooting kit comes to US\$30,000-40,000 (that is a very accessible price point).

2. Image quality. The camera uses a 4K S35mm-sized sensor and 35mm cine lenses, which allow it to create images that are aesthetically very similar to 35mm film.

3. Usability. The camera records to small re-usable media (i.e. hard drives and compact flash cards). Until recently, most Digital Cinema Cameras have been tethered to large recording devices making them much less mobile.

**Red Drive attaches to the back of the camera**



## 5. RAW workflow in practice: Red One vs Film.

### Film

Physical, organic and chemical.



Processed by lab.

### RAW

RAW is digital, written to re-usable hard drive or Flash Cards and IT centric.



Processed by computer.

The major point of differentiation between a film camera and a Red One is not operational; you still need the same crew. The difference lies with the recording medium. This is where you will see the major changes to budgets. The Red One records in the Redcode RAW format onto reusable digital media, allowing several hours of footage to be recorded without changing media if you are recording to a hard drive. This footage is then processed digitally via a computer.

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### Budget Variables

#### Cost of camera rental

- 35mm \$800-4000 (ex lens)
- 16mm \$400-2500 (ex lens)
- Red One \$800-2000 (ex lens)

#### Cost of stock

- 35mm 400ft \$380-450
- 16mm 400ft \$200-250
- Digital Media \$0-200  
(per day, depending on rental package)

#### Cost of Processing

##### Film:

Film processing, telecine to video, tape stock.

##### RedCode Raw:

Post-house transcodes to video via computer rendering, delivered on hard drives.

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### Changes to Budget

While film stock and processing costs are immediately taken out of any budget, offering substantial savings when compared to film, other costs of the RAW workflow must be taken into account, such as recording equipment, an on set Data Wrangler, IT infrastructure and transcoding to other formats such as Apples 'ProRes' or Avid's 'DNxHD'.

## 6. Pre-production with Red One.

### Flat RAW image



### Look One



### Look Two



One major advantage of RAW lies in their ability to apply non-destructive 'looks' to the image in camera. These 'looks' are piped out of the camera on set, and then travel with the footage through the whole workflow pipeline.

With the RAW workflow colour management starts in pre-production. Camera testing specific 'looks' for a production replaces film stock tests.

A colour technician works with the director and DOP to establish a set of 'looks' for the various sections of the project.

These 'looks' are loaded into the camera and will automatically move with the footage throughout the workflow. They are non destructive i.e. they may be changed at anytime throughout the process without modifying the RAW data.

These 'looks' are used to generate the onset viewing from the camera, dailies and off-line editing files. Spending time to create the right look can aid in critical creative decisions, save time in processing footage and allow faster final grading.

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### Changes to Budget

A colour technician needs to be budgeted for in preproduction. This technician works with the director and DOP to develop the right 'looks' for the project.

## 7. On set with the Red One.



Crew requirements for shooting with a camera like the Red One are the same as those for a 35mm or 16mm film shoot. The camera is rated between 320-500ASA so less light is needed for the optimal noise floor.

A sound guide track is entered into the camera to provide synced dailies.

Film stock is replaced by hard drives or compact flash cards. Digital media is swapped out when full and passed from the camera assistant to the new addition on the set, the Data Wrangler.

The Data Wrangler manages the many gigabytes of data generated from the camera. They use a laptop to visually check the footage and run applications for data integrity. This allows any mistakes to be flagged on set, and helps to minimize the risk of expensive re-shoots.

The footage is then copied to two separate hard drives. One stays with the production and the other travels to the post house for processing. Having two original copies of the day's shoot offers the highest security available.

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### Changes to Budget

The Data Wrangler is added to the camera department. The equipment and IT infrastructure must be included in the budget. No syncing rushes. Major savings in post workflow from synced sound directly in camera.

**8. Post Production workflow with the Red.**

**Dailies & Off-line Editing**

*Footage Processing*



The Red Raw footage is processed into video for dailies and off-line editing on Avid or Final Cut.

**On-line Footage Accessibility**

*Data Vault*



The Red Raw footage is kept on a large data vault to obtain access to the footage for image effects.

**Data Security**

*LTO Tape Back-up*



The Red Raw footage is archived on LTO tapes. These are large format data tapes used by banks and corporations to store data.

The footage is processed in a variety of ways for different post-production elements.



**Back-up drive from set**

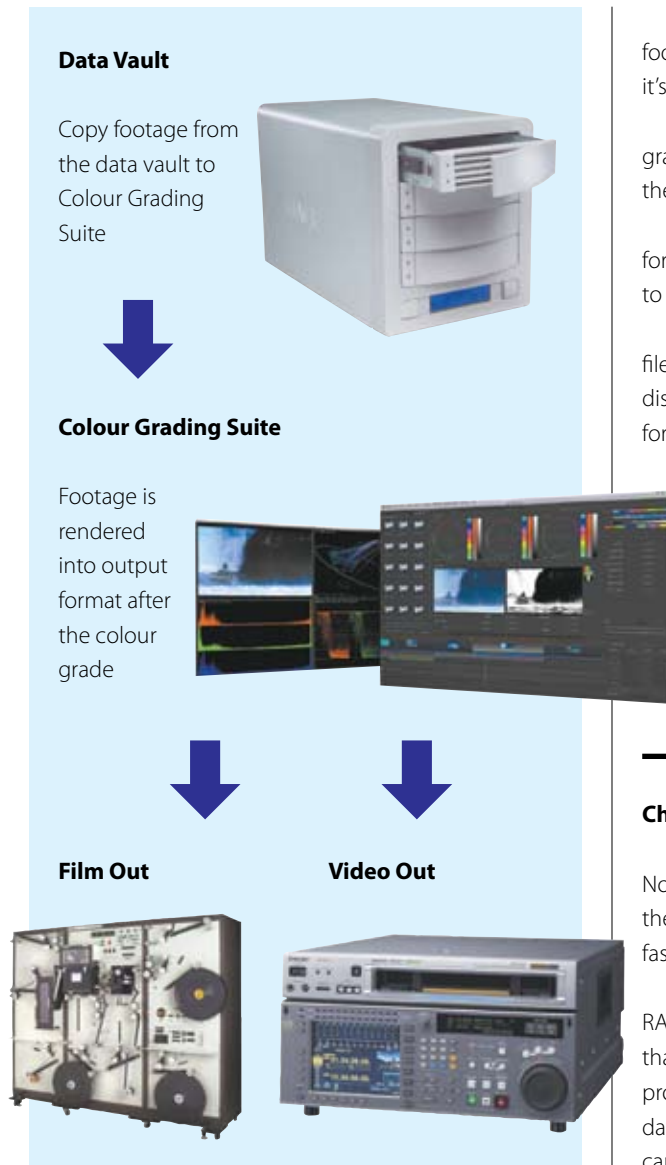
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**Changes to Budget**

The RAW footage generated by the camera is transcoded into video for dailies and offline editing with the 'look' generated in pre-production. Computers are used to process this footage and costs are dependent on the amount of computer power used.

The cost of data storage must be allocated, usually a combination of a data vault and solid tape back-up solutions. Archiving in purpose built facilities needs to be addressed for the long-term life of the footage.

## 9. Grading with the Red One.



Once the off-line edit is complete, the original footage doesn't need to be scanned or ingested because it's already on hard drives.

The data vault is connected to the colour-grading suite and the appropriate files are copied for the colour grade.

The project is conformed and graded in the RAW format and not video. This allows the maximum quality to be extracted from the images.

Only when the grade is finished are the RAW files converted into the most appropriate format for distribution; printed to film, recorded to tape or encoded for digital distribution.

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### Changes to Budget

No film scanning. Digital Intermediate is performed in the RAW format. This makes conforming your footage faster and more cost effective.

RAW formats generally require less hard drive space than comparable video formats (due to their lack of processing), which further reduces costs. And because data rates are lower, desktop colour grading solutions can be used to further reduce grading costs.

## 10. A new approach to Production Services.

The trusted film workflow is now being challenged by new technologies offering a mixture of extended creative possibilities, workflow efficiencies and cost savings. And it is safe to assume that the number of these technologies and choices will only increase in the future.

Producers may find this technological tsunami overwhelming, and the prospect of incorporating these digital technologies into their productions daunting.

But it is important that they learn about these new developments and are able to adapt to them, because the tides are changing.

*Michael Carn is the manager of Highdef Video Services, A Sydney-based company providing digital cinema equipment, workflow and post production services for television commercials, television series and feature films. You can find out more about them at: [www.highdefvideoservices.com.au](http://www.highdefvideoservices.com.au)*