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CAMERA DESIGN

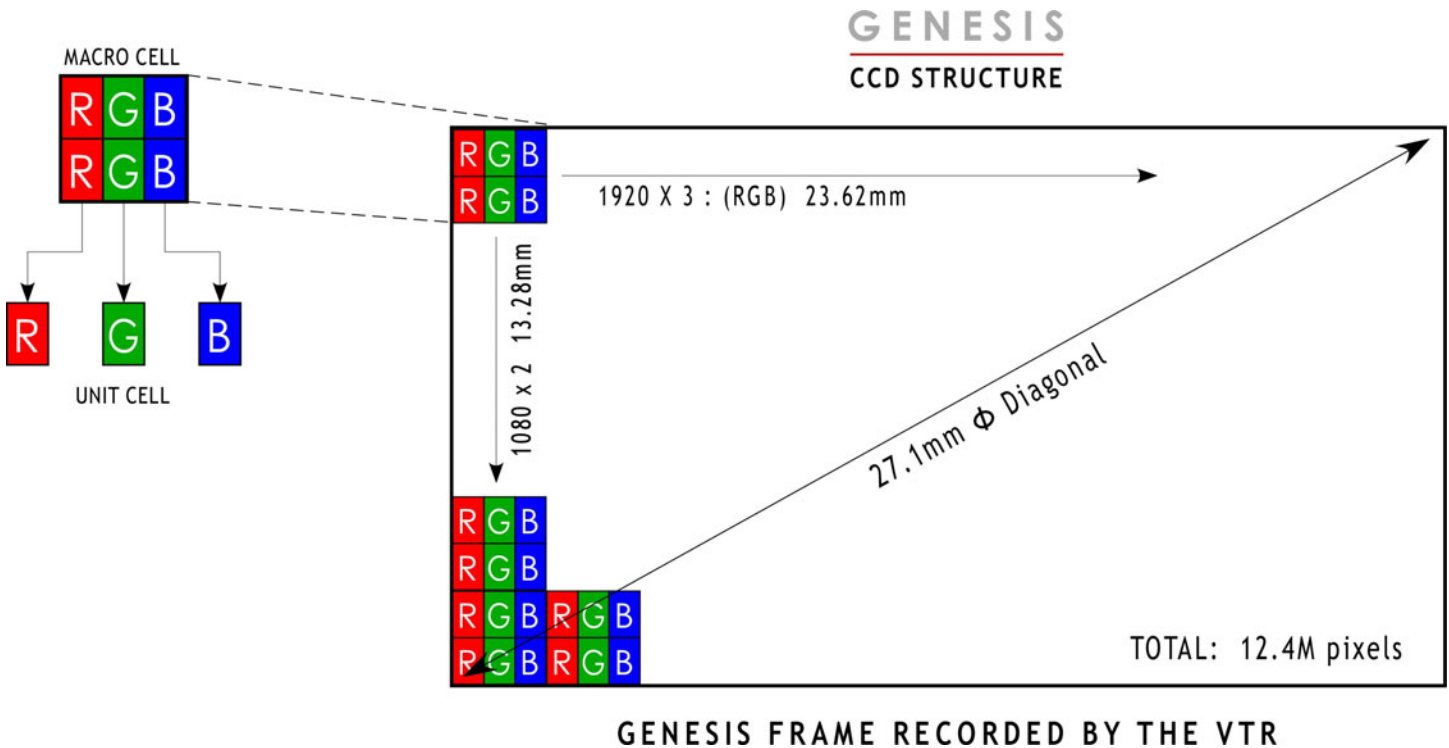
How does Genesis offer so much latitude and sensitivity?

When designing the Genesis, Panavision did extensive research and testing which determined that a 1920 by 1080 pixel, 35mm-size CCD was the “sweet spot” for cinematography. If the sensor had been designed with more pixels (for example as a “4K”) it would have been less sensitive, while if it had been built with a smaller sensor (for example as a 2/3”) it would have had less latitude. By choosing the right combination of pixel size and format (along with other choices) we were able to build a camera that clearly outperforms other electronic cameras.

The technical specification for Genesis sensitivity is E.I. 400, but due to its increased shadow sensitivity compared to a similar speed film emulsion, many cinematographers rate Genesis at higher than this nominal value, and estimate the latitude of the Genesis at almost 10 stops.

How does the Genesis CCD work?

The Genesis CCD is a 12.4 megapixel sensor arranged in a 1920 by 1080 array. It is comparable in size to a 1.78:1 Super 35 mm film frame. It is a true 4:4:4 RGB array, (the same number of pixels are used for Red, Green and Blue), producing equal resolution in RGB unlike a “Bayer pattern”, a compromise used in some other digital cameras.



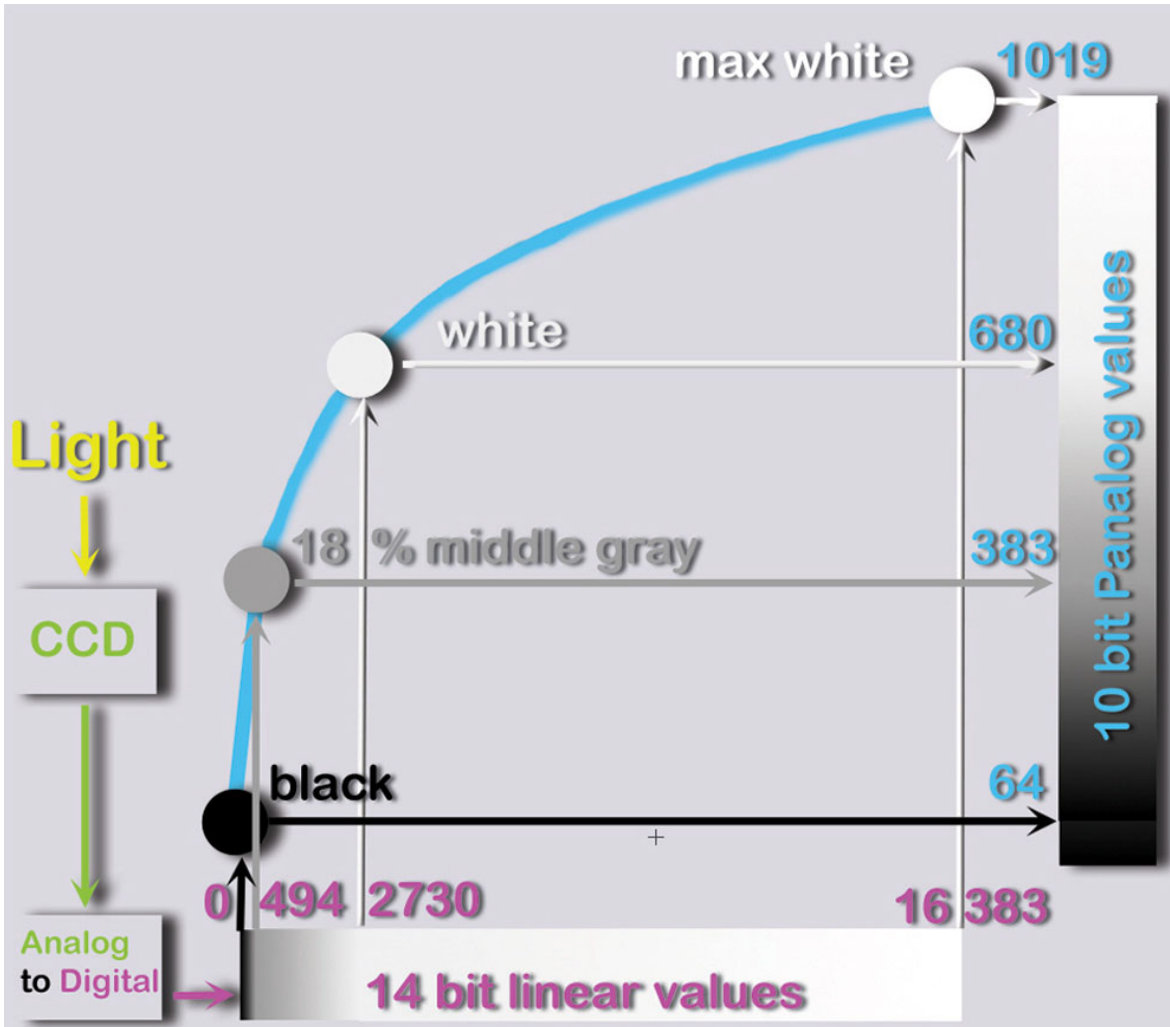
What is the Genesis camera's output?

The 12.4 megapixels on the Genesis sensor are binned into a 6.2 megapixel, 14 bit per color linear signal which the camera electronics then converts to a 10 bit quasi-log, 1920 pixel by 1080 line signal. The output is available in RGB (4:4:4) or Y, Pb, Pr (4:2:2). Each frame is recorded on the VTR with 10 bits of information per pixel. Most productions shoot RGB 4:4:4.

CAMERA DESIGN (continued)

What is Panalog?

Panalog is a transfer curve developed by Panavision to transform the internal 14 bit linear digital signal into a 10 bit quasi-log signal. Panalog is carefully designed to capture and preserve the entire range of the camera's signal. Panalog creates a perceptually equal grayscale with more values in the darker regions of the image than a linear system.



The Panalog curve converts 14 bit linear to 10 bit log

LENSES AND FILTERS

What lenses can we use with Genesis?

Genesis uses the same lens mount as Panavision 35mm film cameras so you can use virtually any Panavision spherical 35 mm lens. Genesis also works perfectly with Hylens systems and other specialty optical tools.

Do I have to adjust lens back focus with Genesis?

Back focus is not necessary. Genesis uses a 35mm single chip sensor mounted directly to the camera body, so the dimensions are very stable.

LENSES AND FILTERS (continued)

How do I shoot for anamorphic release with Genesis?

Genesis does not use anamorphic lenses to arrive at a 2:40 output. Instead, as with Super 35, anamorphic release is achieved by extracting a 2.40 frame from the 1.78:1 image and then doing a digital squeeze when going out to film from the DI. Film print tests have shown that the image sharpness is comparable to 35mm shot with anamorphic lenses.

What lenses work best with Genesis?

Most cinematographers prefer Primo lenses because of their extremely high performance. However, if you want another look, any of Panavision's spherical lenses can be mounted on Genesis.

What about using Cooke S4s or other PL mount lenses on Genesis?

The design of PL mount lenses does not allow them to fit on Genesis.

Are there any Panavision lenses that do not work on Genesis?

Virtually all Panavision spherical lenses work properly on Genesis. Anamorphic lenses can also be mounted but will provide a distorted image.

Can I use my regular filters?

Yes, filters can be used as you normally do. However, their effects may be slightly different than what you are accustomed to. Panavision recommends that you test the filters you are planning to use to see their results. You can see and judge the results directly on the HD monitor with high accuracy.

What about rear mounted filters and nets?

Genesis uses a special behind the lens magnetic mount to hold gels directly to the sensor block. In addition you can use rear mounted nets on the lens as you normally do.

CAMERA OPERATION

I'm a film person, how easy will Genesis be for me to use?

Genesis camera was designed to work comfortably within the established practices of film crews. Genesis cameras take most of the standard Panavision 35 mm accessories. Camera assistants familiar with film will find the same follow-focus, matte-box, filters and heads that they already use for 35 mm. The SRW1 VTR is mounted like a Panavision magazine either above or behind the camera. Genesis comes loaded with carefully chosen default settings so the AC has a minimum of menu functions to access when setting up.

Cinematographers and directors can call for the same lenses, and get the same look and depth of field as standard 35 mm. Many directors of photography light for Genesis the same way they would light for an E.I. 400 or faster film stock.

Two key differences from the film experience are that HD monitors are incomparably sharper than 35mm video assist, and that "reloading" 50 minute cassettes is almost instantaneous.

What if I'm a first time user- what kind of support does Panavision provide?

Panavision offers support on several levels. For the DP who is using Genesis for the first time, we offer the assistance of our technical marketing staff, a group of very experienced people stationed at Panavision locations around the world. They all have years of experience with digital cameras and can help you determine what you can accomplish with Genesis.

CAMERA OPERATION (continued)

And just as with a film shoot, we can provide cameras in advance of your start date so you can do your testing to develop the project's Look. For the assistant, we offer training to ensure that your show will run smoothly from day one. For first time users, a technical marketing representative may be available to accompany you for the first few days of production, to answer any questions that may arise as you start working with the camera.

Do I need a DIT (Digital Imaging Technician)?

Panavision believes this decision is best made by the cinematographer based on the needs of the production. We offer specific training for DITs working on Genesis shows.

Do I need a waveform monitor?

Some DPs swear by them, some use only a light meter and some want the benefits of both. Panavision will set up your show with the monitoring package you want regardless of what that is.

Do I have to learn a lot of menus to use Genesis?

It isn't necessary to learn a lot of menus. During prep, you will use several menus to set up the camera, notably to define monitor frame lines. On the set, you will use a menu to change time code when switching cassettes, and another menu to go to and from a variable frame rate, when needed.

What kind of field maintenance will I have to do?

Beyond normal cleaning there is very little field maintenance to be done on Genesis. Panavision provides information and training necessary to do simple field procedures.

Can Genesis run at variable speeds?

Yes. Genesis cameras can shoot and record at any fixed speed from 1 to 50 fps. However, the camera does not ramp between speeds. **An important note: The SRW1 will not record variable speed correctly when the camera is separated from the recorder.**

At what frame rate do you normally run Genesis?

The nominal frame rate you choose will depend on the release requirements of your project. Genesis offers the following fixed progressive frame rates: 23.98P – 24P – 25P – 29.97P and 30P.

Most Genesis features have been shot at 23.98 fps. This allows for on-set playback of down-converted NTSC video with sync sound. Most US Genesis TV is shot at 23.98 fps, while European and Australian TV are shot at 25 fps. It is also possible to shoot interlaced frame rates of 50I, 59.94I and 60I. The disadvantage of interlace is that the image is captured in two different moments of time, creating motion artifacts. Most productions do not shoot interlace unless intercutting with television cameras is required. (Also see post production workflow question below).

What is the range of shutter angles available on Genesis?

Genesis's shutter can be set at any angle between 3.8 and 360 degrees.

What is the effect of shooting with a 360 degree shutter?

At 360 degrees (or "Shutter Off") the exposure time is twice as long as it is at 180 degrees. Therefore the 360 degree shutter captures more motion blur, and more light, than 180 degrees. You can use the shutter for artistic effect or to gain an additional stop of exposure, or both.

Can I genlock Genesis to an external video source?

Genesis can be genlocked in the usual way to a standard external HD-SDI video signal.

In addition, Genesis outputs an enhanced tri-level signal with frame rate, shutter angle and phase information that can only be used by another Genesis camera.

If you connect the REF OUT from a master Genesis to the GEN LOCK input of a slave Genesis, the slave camera will follow the frame rate, shutter angle and shutter phase of the master camera. These enhanced genlock features will not work if you connect a standard video signal to the GEN LOCK input of the master camera.

CAMERA OPERATION (continued)

How do I deal with HMI lights at either 50 or 60 Hz?

The effects of HMI lights are identical on Genesis and Film, and require similar shutter settings. The advantage of Genesis is that you can see any pulsing directly on the monitor.

Can I intercut Genesis with film?

Yes you can. Genesis and film intercut beautifully. Panavision recommends that you shoot tests with the emulsion you are planning to use, and work with your post house to develop your strategy for handling the two materials.

What about white balance?

Genesis does not use white balance, therefore it is not necessary to shoot a white card for proper operation.

What about visible dust on the sensor?

Dust can be a serious problem for large-format single-chip cameras. This is because, unlike a film camera, when dust lands on a sensor it isn't whisked away by the movement of the film. Dust particles are visible but can be difficult to see unless you are looking closely at the image on a large monitor.

In order to minimize dust problems the Genesis design includes a sealed space between the pre-filters and the CCD. The position of the filters usually ensures that dust landing on the front filter surface will not be visible in the image. Nonetheless camera assistants should be vigilant about dust, especially when shooting day exteriors with high T stops. (Also see viewfinder question below). **An important note: Never use compressed air in or near the Genesis lens mount as this could introduce dust. Use an anti-static brush instead.**

What about working in heat, cold, dust and rain?

Genesis has proven itself in deserts and ice fields. The camera and recorder are designed to work well under a wide range of temperatures.

In extreme heat, the customary precautions you would take with a film camera (umbrellas, etc.) make sense for Genesis too. In addition, batteries should be changed out when their voltage drops to 13.1V to keep the cooling system working at full capacity.

The camera also performs well at temperatures well below zero, although battery performance begins to suffer. Rain and dust can be protected against with custom bags and covers. If you will be filming in extreme conditions you should discuss your needs with a Panavision representative.

What about taking the camera directly from heat to cold or vice versa?

Use the same rules that you would follow with a film camera. Avoid condensation by keeping the camera in the environment it will be working in, and don't subject it to sudden temperature shifts.

What about electronic interference?

Like all electronic cameras Genesis can be affected by electronic signals under certain circumstances. The simple solution to an interference problem is to move the troublemaking equipment, like powerful walkie talkies and some solid state lighting ballasts, away from the camera. That should solve the problem.

When shooting at very bright point sources the light sometimes makes a vertical line in the picture. What is this?

All Interline Transfer CCDs are subject to a phenomenon called "vertical smear". It is the result of serious overexposure in a small region of the sensor that overloads the light sensitive element.

If the problem is caused by a specular reflection, the easiest thing to do is to dull it or knock it down by changing the lighting. If it is caused by a light source it may be possible to slightly dim the source or aim it a little differently. Like anamorphic flares, vertical smear is an artifact of the system which rarely occurs but can happen.

CAMERA OPERATION (continued)

What if I have to change out part of the system in the field – does everything interchange?

All the camera pieces interchange just the way you are used to – including camera bodies. There is no tweaking necessary to get various cameras to look the same.

Why doesn't Genesis have an optical viewfinder?

Panavision's first electronic camera, the Panacam, offered an optical viewfinder. So we certainly understand the debate, but after studying the problems created by adding an optical viewfinder, we concluded that an electronic finder was a better solution.

On film cameras the optical finder is used for framing and focus, judgment of light and exposure balance. With electronic cameras most crews separate these tasks into separate areas and judge exposure, lighting and focus on large high-quality monitors. This leaves framing as the critical task for the viewfinder, and framing can be accomplished with an electronic viewfinder.

Freed from the constraints of film camera design, the benefits of designing an electronic camera without an optical viewfinder are threefold.

1. Building the camera without an optical finder shaves between three and four pounds from the total weight.
2. Removing the mechanical shutter allows the cinematographer to shoot using the electronic shutter at angles as great as 360 degrees. This allows the camera to capture up to one more stop of light. For instance on *Apocalypto* Dean Semler sometimes rated Genesis at an E.I. 2400 by using the 360 degree shutter and adding 1 stop of gain.
3. A major problem for large format electronic cameras is dust landing on the sensor. This is because unlike a movie camera, when dust lands on a sensor it isn't whisked away by the movement of the film. Genesis is much more resistant to sensor dust than digital cameras with spinning mirror shutters. This is because the elimination of the spinning mirror allowed the Genesis designers to place a large sealed cavity between the rear of the lens and the surface of the CCD.

BATTERIES, HEADS AND ACCESSORIES

How is Genesis powered?

Genesis is powered by specially designed high capacity batteries or an AC supply. Because the camera draws a significant amount of power the battery cables are limited to a maximum of thirty feet (nine meters). To avoid interference with other equipment only use battery cables supplied by Panavision.

How long does a battery last?

You can expect between two and three hours of battery life with a normal package including on board monitors, etc. This does not apply in extreme heat or cold. When the temperature rises above 110 degrees, batteries should be changed when their output nears 13 volts. Similarly, when temperatures drop well below zero, you should expect reduced performance from the batteries.

How long does it take to recharge a battery – how many will I need?

The normal recharge cycle for a battery is six or seven hours. Most crews take three or four batteries per camera.

Can Genesis be used on remote heads and cranes?

Yes, Genesis is perfectly suited to remote use. The fifty minute load is great for shooting without having to bring the crane down for reloads. Just mount the camera on the head and you're ready to go.

BATTERIES, HEADS AND ACCESSORIES (continued)

What regular and remote heads does Genesis work on?

Genesis works properly on all regular geared and fluid heads. In addition it is easily mounted on most remote and stabilized heads including Libra, Hot Head and Power Pod. If in doubt regarding a specific head call your Panavision representative.

How about hand held and Steadicam use?

Genesis is being used every day for handheld and Steadicam work. The camera weighs about 28 lbs with the recorder on board, but it's nicely balanced for hand held shooting. For Steadicam you can either shoot with the SRW1 recorder on board or remove it and run BNC cables from the camera output to the recorder. The Genesis body weighs only 14.5 lbs with the videotape recorder removed.

What about shooting on car mounts or in airplanes?

Genesis mounts just like any Panavision camera but in many cases it's even easier to work with than a film body, because the SRW1 recorder can be easily separated from the camera body.

Are there any accessories that don't work with Genesis?

Almost every accessory you might normally use with a film camera can be used with Genesis, except for film-specific accessories like the Panaflasher. Genesis is designed to be used just like our film cameras. Matte boxes, Panatapes and more operate the way you are accustomed to. There are a few brackets and accessories that won't fit but, for the most part, it's the Panavision system you already know. One notable accessory that won't work on Genesis is the Standard Definition on-board monitor – it is replaced by a High Def version.

Will a Preston work with Genesis?

Yes it will. It is mounted and powered as usual. The only thing that is different is the remote start-stop cable.

What about other accessories, can I power them as usual?

Yes, the camera has multiple convenient power outlets. Most standard cables will be the proper length, but be sure to test if you are planning a special application.

Can I photograph TV and computer monitors?

Yes you can. Genesis works with various hi-def sync boxes to keep the frame rates together. LCD, DLP, and LCoS displays do not require a sync box because they are progressive.

I'm shooting underwater. Is there an underwater housing for Genesis?

Not yet, but at least one company is working on one. There are splash bags available for wet shooting conditions.

THE SONY SRW1 VIDEOTAPE RECORDER

Why does Genesis record on videotape?

Panavision sees three advantages to videotape:

1. Videotape recorders have a proven track record in the extremes of temperature, humidity and mechanical shock that are commonplace in today's productions.
2. The 50 minute duration allows for lengthy takes and rapid reloads.
3. Feature films require hundreds of terabytes of data, and videotape offers a very practical way to protect all your footage for the future.

Sony developed the HDCAM-SRW1 field recorder to directly interface to Genesis and in that mode the VTR is seamlessly controlled and configured by the camera.

THE SONY SRW1 VIDEOTAPE RECORDER (continued)

If need be, you always have the option to record Genesis 4:4:4 Dual Link HD-SDI outputs to flash memory devices, a separate hard drive, or other storage solutions. Genesis can be recorded by any system that accepts dual link HDSDI.

What is the recording time for a standard cassette?

At 24 frames per second in standard SQ mode, the SRW1 records 50 minutes per cassette. Just as with a film camera, you get more or less recording time at lower or higher speeds. At the top speed of 50 fps, the cassette recording time is halved.

If I split the camera and the recorder can I still record 4:4:4?

Yes, you can connect two BNC cables between the GADC Genesis Active Downconverter [aka “BNC box”] and the VTR to record dual link HD-SDI 4:4:4. However, when shooting at speeds of 30fps or more, the recorder must be set to 4:2:2 to accommodate the huge amount of data generated. When Genesis and SRW1 are separated, care must be taken to set each unit to the same recording format. When connecting the camera to VTR, use Canare L5CFB cables or equivalent. With the GADC, do not run lengths of more than 100m (330ft) without an amplifier. With the GPD L Genesis Passive Dual Link, do not run lengths of more than 23m (75ft) without an amplifier.

What do I need to clone tapes on the set?

Cloning requires either two SRW1s or an SRW1 and a Sony SR5000 or 5500 deck. Panavision recommends that a qualified person keeps watch during the duplication process to insure that any mistakes or problems are caught before leaving the set or location.

How does the SRW1 record audio?

The recorder has two XLR analog inputs which can be set for Microphone or Line level signals.

How is the VTR time code recorded?

VTR time code (TC) can be generated internally or externally. If your production has opted for external time code, you should consult the post-production supervisor for a detailed description of how they want to implement this, as there are a host of different options. Some of the choices include what kind of external TC generators will be used, whether to feed TC or LTC, whether to have User Bits, whether to Gen Lock or not, etc...

What is the difference between REC RUN and FREE RUN time code?

In RECord RUN mode, the time code (TC) generator only increments while you are recording. This yields continuous TC on the finished videotape. Variable speed recordings must be done in REC RUN.

In FREE RUN the TC generator usually acts as a clock, using the “time of day”. This creates discontinuous TC on the videotape, but is sometimes used to synchronize multiple cameras.

Do you have to jam sync time code when recording with a separate audio recorder?

There are two methods to keep sync. Either a time code slate is held in front of the camera or a Clockit or similar device is used to synchronize the camera and sound recorder. External time code units should be unplugged when working in variable speed mode.

Can the recorder run in reverse?

The SRW1 does not run in reverse. When necessary this effect is done in post.

Does the recorder currently offer an intervalometer mode?

No, the recorder does not currently support this kind of operation, although it can be done in post. There is an integration mode that allows you to capture one image for a number of frames and then record the results. The resulting effect is like a skip frame mode with streaking.

What are the considerations for tape storage and shipping?

HDCAM SR tape is very robust. Nonetheless normal precautions should be taken for storage in the field: avoid extremes of temperature and excessive moisture. HDCAM tape is insensitive to airport X rays.

THE SONY SRW1 VIDEOTAPE RECORDER (continued)

Where can I purchase HDCAM SR tape?

Panavision supplies fresh, properly stored tape at competitive prices. You can also purchase tape from most Sony professional tape distributors.

Will any other tape work in Genesis?

No. HDCAM SR is the only tape stock that works in Genesis. HDCAM tapes used in the F900 are similar in size but are constructed with a different index hole, consequently, the tape will not thread in the SRW1.

How can I be sure the scene was recorded properly?

By pushing the “Record Review” button, you can safely play back the last three to ten seconds of your recording. Panavision does not recommend playback without using Record Review on the set, because there is always a danger of recording over your “original negative” or of creating a time code discontinuity.

Can the Genesis signal be recorded by anything other than an SRW-I recorder?

Yes, Genesis outputs an HD-SDI ten bit stream that can be recorded by any properly configured recording device.

What is the Genesis Display Processor (GDP)?

As noted above, the Panalog transfer curve changes the Genesis output signal to obtain maximum latitude. This extended range will not display properly on a video monitor: the image may appear overexposed, low contrast and/or desaturated.

Some DPs simply change the on-set monitor settings to get a rough feeling for the final image. The Genesis Display Processor (GDP) can be used to convert the Panalog signal to an image that more closely resembles the desired final result on the set, on video projectors for dailies and during down-conversion for the editing process. (See also post-production below).

By connecting the GDP to a laptop computer, the cinematographer can load, edit, create and export LUTs (look-up tables) for viewing the image properly. The DP can also elect to manipulate the Red Green and Blue gain, pedestal and saturation to previsualize a “Look”, creating an image that gives an indication to the director, editor and crew of the intentions for the final DI. (Note that, while values in the GDP memory will be stored, the temporary scratchpad will be cleared upon power down).

Naturally, it is prudent for the cinematographer to engage the post-production collaborators early on to establish the best workflow for viewing LUTs, and communicating Looks.

POST-PRODUCTION WORKFLOW

What does my post production facility need to know about Genesis?

A post-production facility can offer good suggestions regarding frame rate implications, time code, audio “scratch track” options and other choices that may help speed up and lower post cost. Depending on film or video finish Panavision can provide the data required for converting the Panalog signal for use by editorial, visual effects and other departments. To help your post house understand your intentions Panavision recommends that you shoot a properly lit chip chart at the head of every tape instead of color bars.

In addition, Panavision can supply a reference tape with corrected and uncorrected Genesis footage so your post house can dial in their correction.

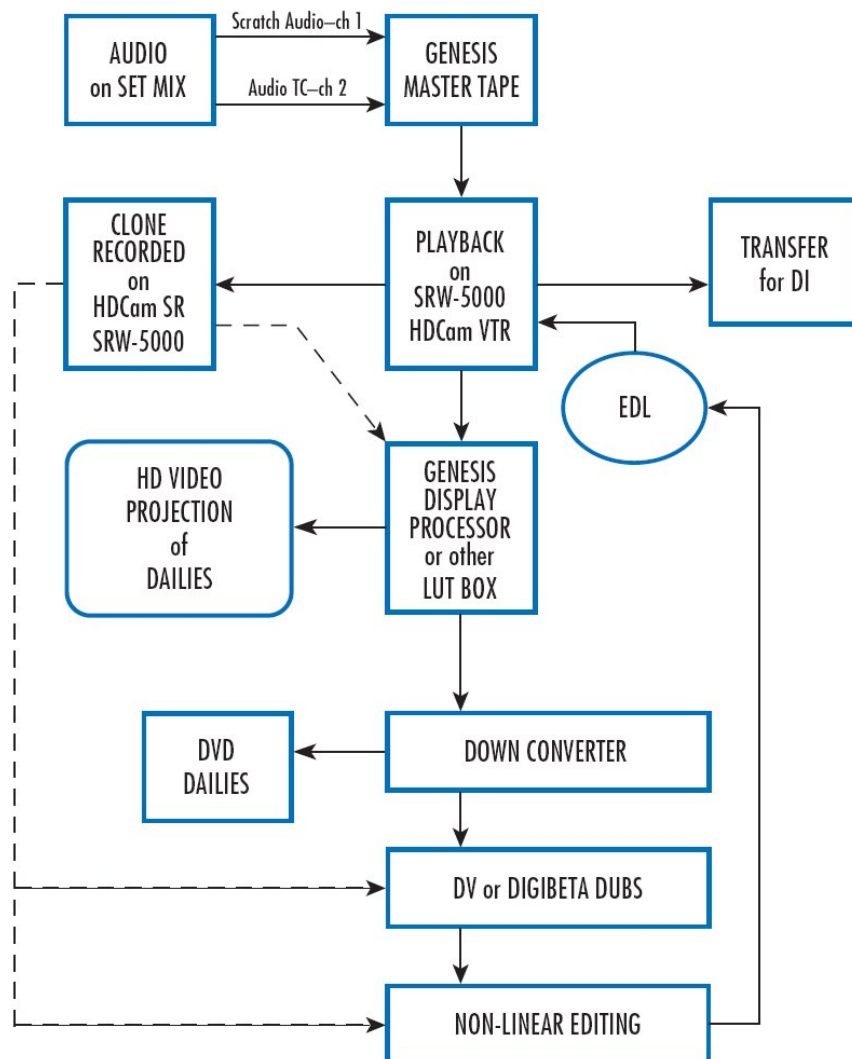
What is a common Genesis post-production workflow for features?

Every production uses a slightly different workflow usually defined in collaboration with the sound recordist, editor and post-production facility. Pictured below are a possible series of steps:

POST-PRODUCTION WORKFLOW (continued)

1. On set, the Genesis master videotape is recorded with 2 audio channels fed from the sound recordist: a scratch track and audio time code.
- 2a. The videotape is copied for safety using 2 HDCAM SR VTRs, such as the Sony SRW-5000 or 5500.
- 2b. A clone is fed through a Genesis Display Processor and into a HD video projector for dailies.
3. A copy is fed through a Genesis Display Processor and into a down converter to record standard definition DVD dailies and a videotape dub that will be fed into a non-linear editor (Avid or Final Cut Pro).
4. After an EDL is generated, the post house will transfer takes from the master videotape to be used in DI (digital intermediate), in special effects, and the final film out. The audio is also conformed and mixed in the customary way.

GENESIS POST-PRODUCTION WORKFLOW



GENESIS SPECIFICATIONS

- Super 35mm-sized sensor
- Equivalent to 35mm depth of field
- Utilizes all existing spherical 35mm lenses, including PRIMO® Primes and Zooms
- Size, weight and ergonomics suitable for handheld, studio or Steadicam™
- Utilizes many of the existing PANAFLEX® accessories
- Dockable Sony SRW1 VTR (no cables)
- 1 to 50 frames per second
- 12.4 mega pixel, true RGB sensor (not Bayer pattern)
- Greater dynamic range than available digital cameras
- Nominal exposure index of 400
- 10 bit quasi-log per color output
- Wide color gamut for film intercut applications
- Dual viewfinder outputs
- Full bandwidth, dual link 4:4:4 HDSDI outputs
- Single 4:2:2 HDSDI monitor output
- Digital lateral color aberration compensation for improved visual effects
- Integrated LCD display provides user-definable access to camera functions
- Option for “Film” menu terms (i.e., “stops” versus “decibels”)

Additional technical information on Genesis is available on the Panavision CD, Panavision flash drive, Panavision website, Genesis quick reference cards, in the Genesis manual, and from your local Panavision representative.