Technical Diary

4 February 2008 (Monday)

- The Canon XL1 was one of the first camcorders to have a low resolution (2 mega pixels) still picture option.

- The camera films at a standard definition of 540 lines. This is the standard used in South Africa.

- High definition is double that of standard definition.

- Be careful to choose the correct aspect ratio. This is the 3:4 option and not the HD 16:9 option.

- The camera gives you an option of recording on either Short Play (SP) or Long Play (LP). Short play is the standard high resolution recording where 1 hour of recording can be taped on a 60min DV tape. LP is the resolution option which allows you to film up to 9min on a 60min tape. However, you must remember that on the LP option, resolution is compromised.

- Always remember to be careful of dust when changing camera lenses as the dust may damage the lenses. Dust can also severely damage your tape.

- There are three focus options on the XL1:
    1. **Manual:** Self adjustment option
    2. **Auto-focus:** By sending out an infra-red signal which finds the middle of the picture, this option allows the camera to focus itself
    3. **Push Button Auto-focus:** The camera person must choose a frame and then press this button, the camera will then auto-focus

- The zebra option is the high contrast monitor and it allows the cameraperson to trim the iris in order to correct any contrast. The iris acts similarly to a human iris as it cuts out the amount of light being filmed.

- Interchangeable XL Lens Mount System: Proprietary interchangeable XL Lens Mount system provides unsurpassed flexibility, superior range and opens up a world of imaging perspectives Ranging from extra wide to super telephoto.

- The XL lenses incorporate the highest quality multi-coated optical elements to achieve 600 lines of horizontal resolution. By exceeding the DV format resolution, the lenses deliver greater visual "sharpness" through its higher sensitivity in the all important 100 to 250 TV line resolution area.

- The XL-1 accommodates an optional 1.6x extender and 3x wide-angle zoom lens (35mm film equivalent of 24-72mm).

- The XL-1 is equipped with 270,000 pixel CCDs, but uses advanced Pixel Shift CCD technology

- Auto (A) - All settings are automatically set. Functions such as Focus, Exposure, and White Balance can be set manually.

- Spotlight Mode - Another Auto mode, this is for when you are shooting bright subjects on a dark background.

- TV (Shutter Priority) - Manually select your own shutter speed from 1/60, 1/100, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/8000, 1/15,000, and the camera automatically sets the correct aperture.

- AV (Aperture Priority) - Manually select your own aperture from 8 F-stop settings (f/1.6 to f/16), and the camera will automatically set the correct shutter speed.

- Manual Mode - Full control over 27 shutter speed and 27 aperture settings, as well as manual control of Focus, White Balance, Gain (five preset levels from -3 to +12 dB) and Exposure Lock. A gauge in the viewfinder indicates when a proper shutter/aperture has been selected.

- Three Digital Audio Modes: The XL-1 offers three Digital Audio modes (16-bit and two 12-bit modes) and is the first camcorder to offer simultaneous recording on four channels, enabling recording of four separate tracks. You can also output each signal independently.

- There are a variety of Audio input terminals with independent level controls, including one stereo mini-jack and two pairs of stereo RCA jacks.

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5 February 2008 (Tuesday)

- In auto mode everything is automated, except for the iris and adjusting of the white balance.

- TV mode allows you to control all of the various shutter speeds

- AV mode prioritizes the control of aperture. Aperture controls how much light gets into your shot. This is used to manipulate depth of field.

- Finally, in manual mode, all of the settings are controlled and can be adjusted by the cameraperson.

Audio Pathways

- The microphone connects into the 3-pronged XLR cable into the input of the SHURE mixer. The camera connects to the output of the mixer.

→ Mic → XLR Cable → SHURE Mixer

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In   →   Camera   →   Out
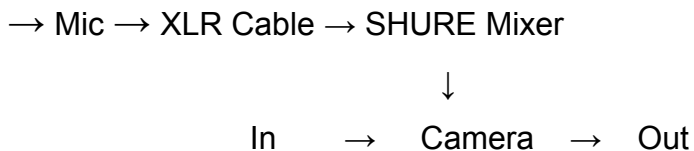
→ Line

- The SHURE Mixer has many settings which control the quality of your sound. For instance, the base cut gets rid of echoes.

- If you put a line input into a mic input you can blow the camera.

- If you put a mic into a line it will not work.

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- To set the tone on the SHURE Mixer, and link it to that of the camera, you must ensure that the tone is set to 1kh and that the master dial is set to -12.

- On camera the tone must be set to 14.

- The on camera mic is known as the stereo mic. It picks up sound from all directions and is ideal for situations such as marches.

- The handheld wireless mic is best used in short range situations. They are best used in standuppers. You must ensure that your receiver and transmitter are set at the same frequency.

- Radio mics work in the same way as handheld wireless ones. They are best used in interviews with one person only.

- The rifle mic should be aimed at the subject's face at about 1.5m distance. The rifle mic is ideally used in intweviews.

Technical Diary – Updated

Lighting Workshop

- Pack Shots
  - In a pack shot there is no other character to the image other than what you can see.
  - Pack shots are lit evenly and are readable and explicable.
  - Pack shots are usually lit by only the key and fill lights.

- Standard Three point Lighting Technique

  - The *Three Point Lighting Technique* is a standard method used in visual media. It is a simple system which forms the basis of most lighting.
  - The technique uses three lights called the **key light**, **fill light** and **back light**.
  - The **key light** is the main light. It is usually the strongest and has the most influence on the look of the scene. It is placed to one side of the camera/subject so that this side is well lit and the other side has some shadow.
  - The **fill light** is the secondary light and is placed on the opposite side of the key light. It is used to fill the shadows created by the key. The fill will usually be softer and less bright than the key and further away from the subject.
  - The **back light** is placed behind the subject and lights it from the rear. Its purpose is to provide definition and subtle highlights around

the subject's outlines. This helps separate the subject from the background and provide a three-dimensional look.

- <u>Night/Moonlight</u>

    o This light is dramatic and moody. It assists in building the story visually.
    o It is created by using gels.

Cables (Digital and Analog)

- NEVER call a cable a cord.
- The longer the cable, the more resistance to the power.
- A two prong plug is 13amps, whereas, a three prong plug has 15amps.
- Yellow = Video ; White & Red = Audio
- BNC (Bayonet, Neill-Consoleman)
  - Professional type of plug
  - Coaxle cable
  - Specifically a video cable
  - Analog cable
  - Used on professional monitors, output of video monitors
  - Invariably, male fixed to the equipment and female must attach to it
  - Teepee will halve the signal so use judiciously
  - Distribution Amplifier (DA) steps up the power and strengthens signal
- RCA
  - Domestic plug
  - Also coaxle
  - Found on household DVD players
  - Carries both video and audio information
  - Worst type of plug to use
- Firewire
  - Found in sizes 4 to 6, 4 to 4 or 6 to 6
  - Digital cable
  - Carries both video and audio information simultaneously
  - 1394 protocol (ieee 1394)
  - Two different types: FW400 and FW800 – same speed as USB2
- Composite video
  - Moving video around – although, worst pathway to choose

- o Only takes video information
- o Analog

- Component
  - o Professional cable
  - o Video only cable

- SVideo/SVHS Cable/YC Cable
  - o Somewhere between Composite and Component
  - o These are the cables found in our packs
  - o Much cleaner than composite
  - o Used for monitoring and dubbing
  - o Used to transfer from analog to digital
  - o Carries only video information

- Remote Cable (9 pin)
  - o Only carries control information (NO video or audio)
  - o Also known as RSS Control Cable
  - o Also come in 26 and 15 pin

- XLR/Canon/Canon XLR
  - o Three plugs: Neutral and Left & Right
  - o Audio information only

Depth of Field

- Great Depth of Field (DoF) = sharp
- Shallow DoF = soft
- To focus, zoom in completely, focus, and then zoom out
- For movement, LOWER shutter speed
- If all the information within the image, then a shallow DoF
- If only the subject is important, then a great DoF
- There are three ways to manipulate DoF:
    - Iris
    - Focal length (how far you're zoomed in on a camera)
    - How far the camera is from the actual object
- Iris
    - Mechanical part of camera which controls amount of light which is let in
    - Fstop unit of worth to iris. The smaller the fstop number, the bigger the opening of the iris
- Focal Length
    - Measure of your target area from your optical area
    - Long focal length = shallow DoF
    - Short focal length = great DoF
    - Subject closer - anticlockwise
    - Subject further away - clockwise
- Distance
    - Manipulation over a shallow DoF is ultimately what is wanted
    - Physically move away from subject for a greater DoF and open the iris
- If subjects are moving then:
    - Autofocus focuses on subject in the centre of the picture
    - Follow the moving people with the lens

- Hit and hold the push button auto focus down
- Allow subject to move into focal plane, get soft and then refocus (tweak)

Camera Movements & Composition

- Extreme Close-up: Space from mouth to edge of frame is MUCH smaller than space from eyes to edge of frame
- It is not aesthetically pleasing if these two spaces are the same in size
- Shots must always be consistent with each other throughout the piece
- Keep eye line constant. Interviewer stays in one place, camera person moves around
- In an interview decide on three primary shots, then work on cutaways and cutins
- When panning, zooming or tilting start the movement very slowly, then fasten up (especially during dead space), then slow down again.
- Try to make movements imperceptible.
- NEVER leave the viewer with nothing to look at

Codecs

- Uncomressed video filed are too large and the data rates are too high to transport effectively over a local area network or the Internet so you have to compress them

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Bitstream Type	Data Rate (Kilobits per second)	Time on One 700Mb CD-Rom
Uncomressed high definition (1920 x 1080 29.97 fps)	745750	7.5 sec
Uncompressed standard definition (720 x 486 28.97 fps)	167794	33 sec
DV25 (miniDV, DVCAM, DVCPRO)	25000	3 min 44 sec
Typical DVD	5000	18 min 40 sec
Video CD	1167	80 min
Broadband web video	100-2000	3 hours 8 min at 500 Kpbs
Modem web video	18-48	48 hours 37 min at 32 Kpbs

- Converting from digital video (DV) to DVD usually entails a 5:1 compression
- Converting an uncompressed source to a modem-compatible video requires a 9000:1 compression
- Only 0.1 of the original data is left
- Type of video (format) and compression type are two different things:
    - One video format may support multiple compression and types and ratios

- o A type of compression may be used in multiple formats

• <u>DVD Formats</u>

- o Modern DVD Burners – 4.7GB of data on a disc (DVD-5)
- o Manufactured DVD's can use a dual layer format – 8.54GB of data on a disc (DVD-9)
- o DVD played in DVD player known as DVD Video
- o DVD-ROM is a computer formatted disc which requires a computer to play it
- o Hybrid DVD Video/DVD-ROM discs exist
- o DVD Video discs mastered in either National Television System Committee (NTSC) format – U.S; Japan or
- o Phase Altering Line (PAL) format – Europe, most of Asia
- o Home DVD player will not play discs set in an opposite region, however, most computers can play both
- o Region Coding is an optional feature

• <u>Video CD Formats</u>

- o Video CD's can play in most personal computers
- o A manufactured Video CD can play in a DVD player
- o Video CD's can be either NTSC or PAL

• <u>CD-ROM Formats</u>

- o The web has largely replaced CD-ROM as a medium for interactive content
- o CD-ROM used for computer games and kiosks
- o Compared to web video, CD-ROM offers much higher bandwidth than broadband connections and is capable of DVD quality on fast computer

• <u>Internet Formats</u>

- o Bandwidth available on web, much less than on disc
- o Web enables developers to update software at any time

- Web video can use either real-time streaming mode or progressive-download mode
- Real-time streaming files require specialized streaming software and are limited by the amount of bandwidth available
- Progressive-download files load from standard web servers and may take a long time to download, however, the quality is generally better

• **Compression and Mobile Devices**
- Most compressed video formats can be played on some mobile devices
- There are no universal settings or formats for mobile devices
- Content has to be optimized for a small class of devices or particular model

• **Understanding the fundamentals of compression**
- Compression technologies take advantage of the weaknesses in human senses by reducing data that isn't likely to be perceived
- Compression summarizes a sequence of images and sounds
- The endoded files describe the important details of the content as tersely as possible
- A matched pair of a compressor and decompressor (codec) performs the compression

• **Types of Compression**
- **Spatial Compression** also called intraframe compression effects only a single frame at a time
- This ensures that there are no interdependencies between frames and makes editing and random access to any point in the video easy
- Spatial Compression finds redundancy within a frame, either in areas of flat or similar colours or areas of the frame which look like other areas of the frame

- o Many codecs are based on a as technique known as Discrete Cosine Transformation (DCT)
- o These codecs are good for smooth gradation, however , they do not perform well with random details or sharp edges at lower bit rates
- o Visible flaws are known as artifacts
- o Two common types of artifacts are know as: ringing (sharply defined edge has a halo/smudge) and blocking (smooth edge become blocky in appearance)
- o Small text with sharp edges is a common problem area, codecs such as wavelet are best for this
- o **Temporal Compression,** also called interframe compression, adds the ability to use other frames as a reference for the current frame
- o Each frame tends to resemble the previous frame in video
- o Only encodes the changes from one frame to the next (except key frames

• <u>Frame Types and Compression</u>

- o **Key Frames** or I Frames are complete images compressed using intraframe compression
- o The first frame in a movie is always an Key Frame, not based on any other frame
- o Important for accessing random points in a video as the only frames which can be decoded completely by themselves
- o Most authoring codecs, Motion JPEG and DV, only use Key Frames
- o **Delta Frames** are compressed using in interframe compression and contain only the parts of adjacent frames which are different
- o If more than half of the image is different the codec will generate a new Key Frame
- o A Delta Frame is typically only 10-20% the size of the same frame at the same quality as a key frame

- Two types of Delta Frames, **P Frames** (Predictive Frame) and **B Frames** (Bi-Directional Frame)
- P Frames content based on previous frame
- B Frames content based on previous and subsequent frames
- B Frames mainly used in MPEG formats
- B Frames can not use image elements from other B Frames

Colour Modes

- Three basic types of colour in today's codecs
- **Monochrome**, in this mode only brightness matter
- Works best for black and white movies
- **Red, Green, Blue (RGB)** is widely used for screen recordings and motion graphics
- Screen has red, green and blue phosphors for CRTs and planes for LCDs
- Not used for broadcast delivery
- **Y'CbCr** encode luminance and two colour difference channels
- You can convert Y'CbCr to RGB for display
- There will always be some colours available in one not available in the other

Colour Depths

- Define the precision of colours and determine how many gradations of intensity there are
- Measured in the number of bits per channel (bpc)
- **8-bit (Indexed) colour** or 256 colour
- Instead of each pixel having a measurement for red, green and blue, each pixel was assigned a code, and a look-up table translated that code to actual RGB values
- Does not work very well with video, only significant format still using it is GIF
- **5bpc** also called Thousands of Colours or High Colour

- Used for very early video compression codecs
- Today mainly used for screen recording applications where it may provide better compression and performance than 8-bpc colouring without any obvious degradation
- **8bpc** also called Millions or True Colour
- Sometimes called 24-bit or 32-bit mode
- **10bpc** used in high end Y'CbCr authoring systems
- Provides 1024 gradations instead of 256
- **16 and 32bpc,** useful when you have a multi step authoring process, need to apply visual effects to your images or when you convert from and then back to Y'CbCr

• <u>Colour Sampling</u>

- Uses a X:Y:Z format
- X: number of luma samples described
- Y: number of chroma samples per luma sample on the 1st, 3rd, 5th and succeeding odd lines
- Z: number of chroma samples per luma sample on the 2nd, 4th, 6th and succeeding even lines (if this no. is 0 then the no. from the first line is used
- **4:4:4 ; 4:2:2 ; 4:2:0 ; 4:1:1 ; YUV-9**

• <u>Audio Compression</u>

- Most fundamental factor in audio is sampling rate (measured in Hertz, or cycles per second)
- **Bit Depth** is the number of bits used for each sample in each channel
- **8, 16, 20** and **24 bit sampling**
- 24 bit sampling is fast becoming the standard for professional audio recording

• <u>Authoring video for future compression</u>

- **Interlaced versus progressive scan** – historically, interlaced frame was always used, however, progressive scan is much more effective
- **Camera Motion** – the less camera movement, the easier the image is to compress
- Each movement changes every pixel of the image
- **Shutter Speed** – slower shutter speeds let through more light, therefore, less grain which is easier to compress
- **Backgrounds** – foliage is very difficult to compress because of the green, the sharp edges of the leaves and the random movement because of wind
- **Depth of Field** – keep unimportant objects in the background, or close foreground, blurring them slightly
- **Static versus moving images** – moving images are not appropriate for content which you plan to aggressively compress
- **Motion Blur** – you can adjust the virtual shutter in rendering applications
- **Anti-aliasing** – this rendering technique softens the edges of rendered elements, smoothing out the transitions among parts of the images improves compressibility and appearance

Capturing Video: Choosing Formats and Connections
- The higher the quality of the source material used, the higher the quality of the final compression results
- Video can be captured from both analog and digital sources
- **Analog Format** is inherently susceptible to visual interference from electronic noise, suffers attenuation and the loss of quality over long cable runs (+300m)
- Computers only use digital data, so analog must be converted, this conversion can lead to minor errors

- o **Composite, S Video, Component Analog, Unbalanced and Balanced Audio** – see "**Cables**"
- o **Digital Formats** are crisper and clearer than Analog Formats
- o **DV25 (DV) or Firewire, SDI and Digital Audio** – see "**Cables**"

Choosing the right Capturing Codec

- o **DV Codecs**
- o The DV25 format is ideal when capturing from a DV25 deck
- o Over a Firewire connector you can use DV25 to copy the native bits from the tape onto a hard disk making a perfect copy
- o **Motion JPEG Codecs**
- o Motion JPEG is the leading format for high-end video editing systems
- o **Uncompressed Codecs**
- o More and more cards support true 4:2:2 uncompressed video
- o It supports 10bpc captures which perform better for analog and SDI source
- o A fast drive system such as RAID is needed

Exporting Video

- o **Exporting to file**
- o A file you export for later processing is called an intermediate file
- o This provides a high quality in the most useful format without introducing any compression artifacts
- o **Choosing whether to preprocess or to avoid rendering**
- o Preprocessing during rendering results in a smaller file, however, adds more rendering time
- o It also means you can't use an encoding tool for special operations, like inverse telecine
- o To avoid rendering you use the same codec and file format as your source video

- When you preprocess use the highest frame rate and largest frame size you will use
- **Choosing a file format for rendering**
- Most common are Quicktime and AVI
- It is essential to make sure that the encoding tool supports the file format
- **Choosing a codec for exporting**
- When exporting an intermediate file, pick a data rate and codec that don't introduce compression artifacts
- If not preprocessing, use the source codec or Motion JPEG
- **Preprocessing**
- Involves transforming the decoded frame of the source video into the optimized frame given to the codec
- Preprocessing not needed when you convert to video formats like MPEG-2 for DVD and SVCD
- **Deinterlacing**
- Deinterlaced video shows fewer artifacts than interlaced
- Most video is produced and edited as interlaced

Noise Reduction

- Removing things such as grain from an image makes it easier to compress
- Simple noise reduction algorithms are just blurs – they hide grain, but make the image soft
- More advanced algorithms try to blur only the parts of the frame which have grain
- You should use only the minimum noise reduction required to suppress poor quality in the source

Audio Processing

- **Resampling Audio**

- o For low data rates you should reduce the audio sample rate to 22.050KHz or lower
- o **Setting Volume**
- o Peak volume should be slightly lower than the maximum volume
- o **Adjusting channels and bit rates**
- o Mono content encodes better then stereo or lower data rates
- o Set audio to mono at a higher sample rate
- o **Reducing noise**
- o There are noise reduction filters for audio
- o Providing clean, undistorted hiss- and pop- free audio source results in better compression

- **Encoding**
  - o Encoding means defining the correct parameters such as data rate, frame size and frame rate to get optimum results for the project
  - o **Choosing a data rate mode**
  - o Average Limited ; Peak Limited ; Buffer Limited or Quality Limited
  - o **Choosing between encoding speed and quality**
  - o For DVD projects, titles under an hour won't gain much by slower, high quality encoding because the data rate is too high
  - o Web-distributed content will benefit because bandwidth is always the limiting factor

- **Adjusting the Frame Rate**
  - o Number of frames per second at which the video runs
  - o Higher frame rates = smoother
  - o Lower frame rates = choppier
  - o You should try to use the source frame rate if possible

- **Delivery Methods for Video**
  - o Disc based delivery
  - o Downloadable files
  - o Progressive download files

- o Real Time Streaming

- **Choosing a compression format**
  - o **Features**
  - o Often the biggest determining factor of a platform is the features that users need.
  - o Different features vary in their degree of importance.
  - o Compression efficiency is almost always critical.
  - o Real-time streaming scalability is another major feature.
  - o **User base**
  - o With most advertising content, users are unlikely to download a new player or codec. But for compelling content, users may consider making sacrifices. For example, Apple logged several million downloads of QuickTime in the 72 hours after a very popular movie trailer was released.
  - o **Platforms**
  - o Some formats are only available on a single platform or have different features depending on the type, or the version, of the operating system.
  - o In many cases, especially when you create content for the Internet, it may make the most sense to deploy content in multiple formats so that the user has the choice.

- **Exporting to Windows media format**
  - o **Using Windows for streaming delivery**
  - o Windows Media 9 has an excellent streaming architecture, excelling with MBR technology, servers, and codecs.

- The MBR solution in Windows Media format is called Intelligent Streaming.
- Intelligent Streaming can use over a dozen data rate bands for both video and audio. The video bands can vary resolution as well, making it possible to provide a single link that can scale from audio-only for slower modems up to high definition playback for a local area network (LAN).
- The only significant restriction to Intelligent Streaming is that all bands must share the same codec and encoding mode (for example, Windows Media 9 with a 2-pass CBR).

- ## **Extensions**

- There are many different file types and extensions for Windows Media format.

- **.asf**

- The file format used for Windows Media files is called the Advanced Streaming Format, and the original extension was .asf. However, this extension didn't discriminate between audio-only and video files, and so the extensions .wmv and .wma were introduced with Windows Media 7. Today, .asf files are typically legacy content using the Microsoft MPEG-4v3 video codec. However, the file format itself hasn't changed.

- **.wmv**

- A Windows Media Video file (.wmv) is an .asf file that contains video.

- .wmaA Windows Media Audio file (.wma) is the same as an .asf file, but it only contains audio.

- **.asx**

- An .asx file is a metafile for Windows Media Streaming. The .asx file goes on the web server and points to the media on the

streaming server. The .asx file format itself hasn't changed, but with the advent of WM7, the .wvx and .wax file extensions have been used more commonly.

- o **.wvx**
- o A .wfx file is a metafile that contains video and, optionally, audio.
- o **.wax**
- o A .wax file is a metafile that contains only audio.