COMPARISON OF CANON ELURA 80 MINIDV CAMCORDER TO MINI DVR

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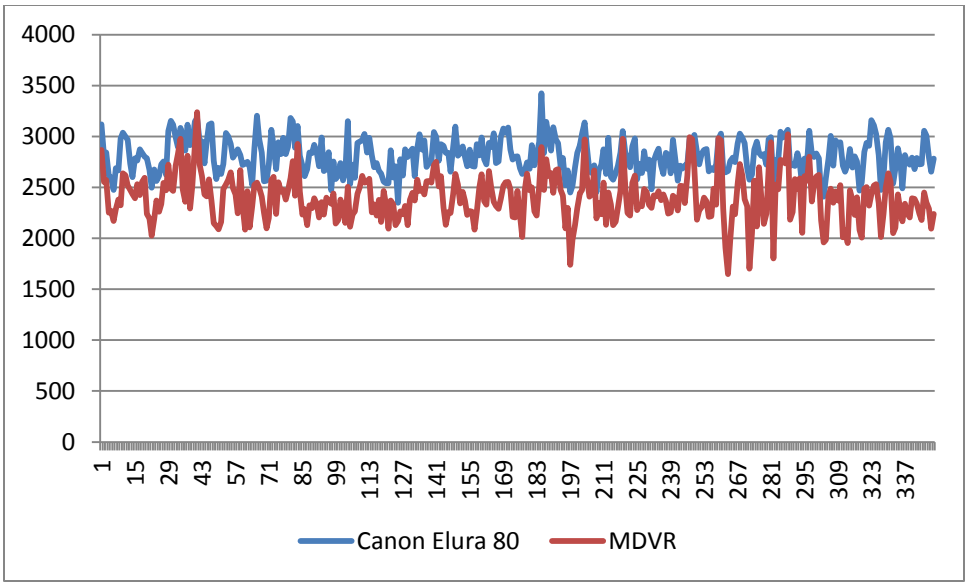
This report compares the recording properties of the Canon Elura 80 miniDV camcorder to the popular MINI DVR digital video recorder similar to this shown here:

General Notes:

MINI DVR only records one field as a frame in 30fps NTSC mode. Canon Elura records both fields in 30 fps NTSC mode.

Bright Star Light Curve Comparison:

Both devices were compared using a 7.582 (UCAC4) magnitude target star (HIP 6451). One telescope was used to gather the light – a Meade LX200GPS with f3.3 focal reducer. A WAT 120N+ CCD video camera was used to create a video output. The video camera was set with gamma equal to 1.0 to allow linear recording of brightness. Other settings were adjusted to assure the target star was not saturated, but relatively bright. A video splitter was used to create two equivalent video output streams. The video output streams were recorded simultaneously by both devices. The videos were both recorded at 30 frames per seconds (fps) NTSC format. The MINI DVR video was recorded to a SDHC data storage card. The Canon video was recorded to a Sony MiniDV digital video tape at SP rate. Both light curves were analyzed by Limovie, using aperture photometry with the same size and orientation of the background and measurement apertures. Here is a graph of the two light curves compared.



It clear there is a loss of 'gain' between the two systems. Also, in the vicinity of frame 267, it is clear that the MINI DVR light curve has extreme 'fluctuations' compared to the fairly constant Canon light curve. The reason for these extreme fluctuations is due to the fact that the Canon is recording two fields for each frame and Limovie is averaging these fields to produce the light measured for each frame. The MINI DVR is only recording one field for each frame (the first field). Fluctuations that occur in the first field are different than those occurring in the second field and the result is the noise distribution is different for each video as well. See below.

Bright Star Noise and Brightness Analysis:

The light curve for each recording was imported to the program R-OTE to examine the brightness level and noise sigma deviation. Also the ratio of the measured brightness and noise sigma was calculated (this is somewhat analogous to SNR; however there is no occultation signal in this data, so SNR cannot be calculated). The results are shown in the table below.

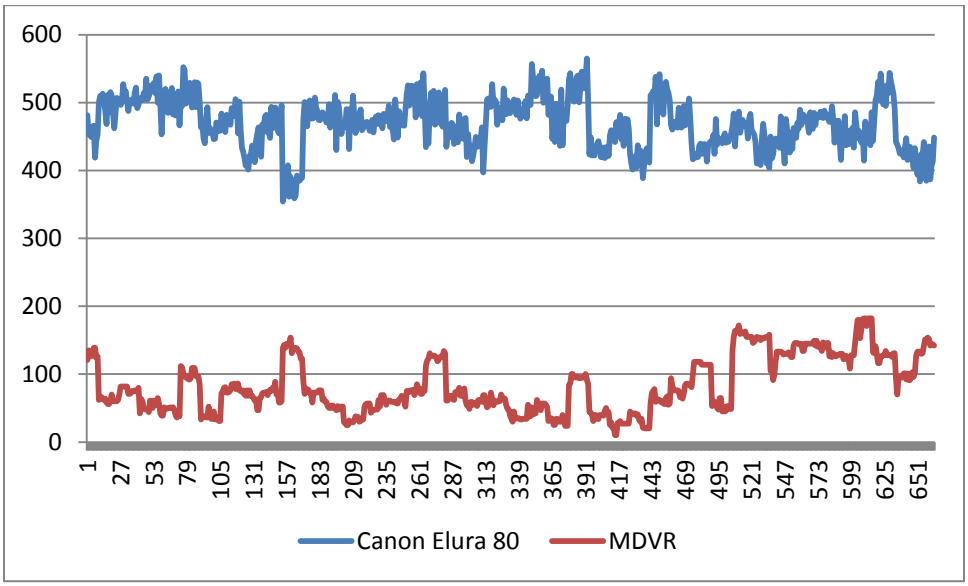
Recording Device	Brightness Measurement	Noise Sigma	Brightness/Noise Ratio	Magnitude Effect
Canon Elura 80	2808.2	171.15	16.40	0.00
MINI DVR	2399.5	226.14	10.61	-0.17

As can be seen, the star measured brightness is approximately 17% higher in the Canon Elura 80 compared to the MINI DVR. The noise sigma is approximately 25% lower in the Canon Elura 80. As a result, the ratio of the brightness to noise is 55% higher in the Canon Elura 80, an indication that SNR would also be much better. The photometric effect of reduced brightness in the MINI DVR amounts to a 0.17 magnitude less brightness.

Faint Star Light Curve Comparison:

Both devices were again compared, this time using a faint 12.4 (UCAC4) magnitude field star (UCAC4 507-001983). The WAT 120N+ camera settings were changed to make the faint star visible on the

screen (an even fainter 13.0 magnitude star was also visible). Gamma was set to HI (0.035). A modest degree of 'integration' was used to allow these stars to be visible. All analysis parameters were otherwise exactly the same. Here is a graph of the two light curves compared.



It is again clear there is a loss of gain between the two systems. We continue to see wider fluctuations in the MINI DVR data than in the Canon Elura 80 data. The most troubling aspect of the light curve comparison is the very large difference in absolute brightness recorded. The MINI DVR noise suppression algorithm that makes the background go 'black' as shown in the visual comparison below, is likely to also cause a loss of faint star brightness. This is very troubling for IOTA work, as observers typically push the limits of visibility in their observations and mobile drift-scan observers, who use smaller portable telescopes, often are very close to the limiting magnitude in their observations.

Faint Star Noise and Brightness Analysis:

The light curve for each faint star Limovie analysis was imported to the program R-OTE to examine the brightness level and noise sigma deviation. The results are shown in the table below.

Recording Device	Brightness Measurement	Noise Sigma	Brightness/Noise Ratio	Magnitude Effect
Canon Elura 80	469.0	37.1	12.6	0.00
MINI DVR	82.9	40.8	2.03	-1.88

As can be seen, the measured star brightness is a huge 565% higher in the Canon Elura 80 compared to the MINI DVR. The noise sigma is numerically similar but slightly lower in the Canon Elura 80; however, when we look at the ratio of the brightness to noise, the Canon Elura 80 brightness to noise ratio is 620% higher. The Canon Elura 80 data SNR would be much better, no doubt allowing the detection of an occultation event, which might likely be lost if the data had been recorded on the MINI DVR. The photometric effect of reduced brightness in the MINI DVR amounts to a 1.88 magnitude less brightness.

Video Frame Visual Comparison: (see following page)

FIGURE 1 CANON ELURA 80 FRAME IMAGE

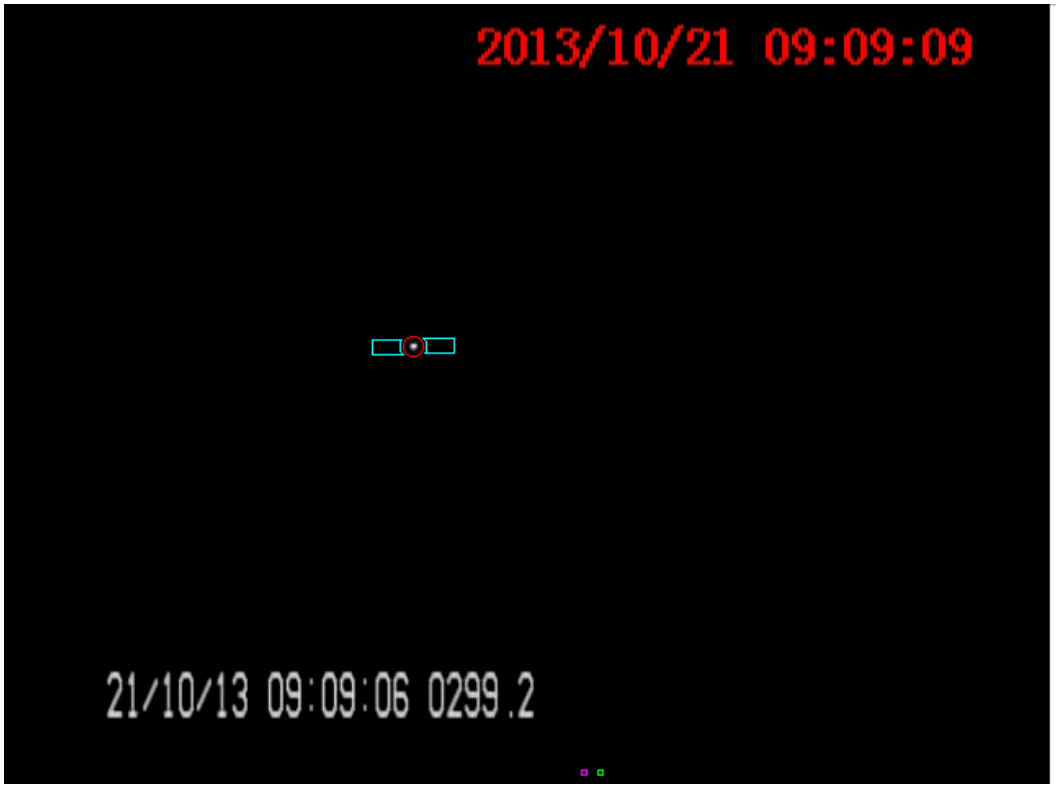


FIGURE 2 MINI DVR FRAME IMAGE

When comparing the screen images from Limovie for both recordings, two things are readily apparent:

1. There is a frame-size compression made by the MINI DVR that is not evident in the Canon Elura 80 recording. This is likely due to the compression algorithms used. This compression changes the size of the pixels, time stamp text, etc., which may result in improper time stamp reading. [Note: for this recording an STV Astro time inserter was used, so reading the video time stamp was not attempted.]
2. There is a marked difference in background density. The Canon Elura 80 recording shows a 'normal' background with typical low-light background noise. The MINI DVR shows essentially a constant black background – no noise.

Conclusions:

A comparative analysis of the recordings of the same video on different recording media – Canon Elura 80 and MINI DVR shows conclusively that the Canon Elura 80 recorder is generally better as a recording device for bright stars and vastly superior to the MINI DVR when recording faint stars.

The MINI DVR only records the first field in the two-field interlaced NTSC video format. Therefore, 50% of available data is lost even before recording begins. In addition, the MINI DVR has compression algorithms that appear to suppress faint light to make the background darker and more uniform. The compression algorithm also changes pixel size and frame size when analyzed by Limovie.

For bright stars the loss of brightness in the MINI DVR is 0.17 magnitude, for faint stars, the loss of brightness in the MINI DVR is 1.88 magnitude. Clearly, the MINI DVR should not be used to record videos where the target star is within 3 magnitudes of the limiting magnitude of the telescope/camera combination.

Other IOTA observers who have both miniDV video recorders and DVRs similar to those analyzed in this report are encouraged to do similar direct comparison of recorded videos.

New observers who are planning to purchase equipment are strongly encouraged to purchase a MiniDV camcorder such as the Canon ZR or Elura (check model numbers for availability of A/D conversion capability and Firewire digital output port).