# Chapter 2 Review of Digital Cameras for T-L use

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June 2006

Since 2000 I have been evaluating digital cameras ranging in price from $100.00 to $10,0000 . Manufactures have included Kodak, Nikon, Canon and Olympus. The camera have come a long way the past years, but they are still limited by the lifetime of their shutters.

The low end "web cams" come with an AVI compression program were the operating system of the camera will automatically make a time lapse. The cameras suffer from both low resolution and very high image compression artifacts. These cameras are also known for many image problems.

The high end cameras are another mater completely. The cameras are under warranty for 100,000 images - equivalent to 70 minutes of film footage. The cameras I have evaluated all had identical problems. If the camera is built around a SLR body, the flipping mirror will be the first item to go , especially if there is no mirror lock.

Summary of problems:
1. Building a time-lapse program for propriety software
2. Mechanical problems ( moving mirrors)
3. Conversion from propriety file formats to standard formats.
4. Duty cycle ( how fast the camera can acquire continuous frames)
5. Locked auto-color balance
6. Temperature stability of CCD

## Digital Cameras That Work

With the introduction of stable, low cost digital cameras, time-lapse cinematographers have been moving to digital acquisition.

I have tested and developed procedures for using digital cameras for time-lapse photography.

The biggest problem facing the photographer is how to trigger a camera every time increment. The solutions are as diverse as the current selections of cameras. Since I mainly use Canon products, these cameras will be the focus of this article.

The 30D is the current Canon product that I use in the lab. The recent introduction of the 5D increased the image size, but also doubles the amount of storage required for a T-L image sequence.
Both the canon 10D, 20D, and 30D will take one image a second and store the image in flash memory. These cameras can not run this fast in tethered mode where the camera will take up to 2 seconds to download an image to a hard drive. The canon D60, 10D ,20D, 30D, and 5D are all shipped with control software that will run the camera in time-lapse mode or interferometer mode as many manufactures call it.

If the photographer wants to run a camera faster than the cameras software( or more importantly run for more than 999 frames , the limit of all modern Canon software) they will require an external controller. The very best on the market is the Time Machine made by Mumford Micro Systems. With a cost of about $300 it is a very good deal and allows a photographer to be very mobile and still have a relatively short setup time. This controller will run down to an interval of one second. The Time Machine can be connected to several dozen different cameras.

It is important to note that digital still cameras are limited by the reliability of the cameras shutter. Most leaf shutters are good for approximately 125,000 cycles. The faster the shutter cycles, the shorter the shutter life. At 1 frame a second shooting clouds the Canon cameras have failed numerous time after only 60,000 frames. Another characteristic of the digital cameras and the shutter is to material falling off the shutter during a T-L sequence. This will cause large particles to appear on the camera sensor in the middle of a sequence. This problem seems to be the worst when the camera is pointed up as in sky photography. To overcome the particle storm created inside the camera, or at least have particles fall away from the sensor shoot clouds by pointing the camera down into a good optical mirror.

With modern digital cameras the exposure is dependent on three factors: the iso setting, the time exposure of the shutter, and the aperture setting of the lens. The modern apertures open before each shot for focusing and clamp down before each exposure. This causes a problem with the aperture not returning to the exact size and causing a difference in light levels. This is one of the sources of flicker in a time-lapse sequence. The second source of error and one that can not be overcome while shooting outside is the exposure variation of the cameras shutter. Of these two variables the aperture can be controlled by moving to manual lenses. There are a number of lenses that will work on the canon bodies, but the best are the 42mm screw mount Pentax lenses. Some of these lenses were the highest ranked of any lenses when they were manufactured. These lenses easily fit on a canon EF body through the use of a canon EF to Pentax 42 mm adapter. This combination of lenses will drastically reduce any flicker in a time-lapse sequence.

To remove any remaining flicker use the program Virtual Dub on an uncompressed AVI movie. Be sure to test out the program – there are a number of bugs in the last release. The plug-in for deflicker is one of the best ever written – and I have tested about a dozen of these programs. Without going into full details the program creates a running average of the luminance and then uses this average to adjust each frame in a sequence. If works very well.

To combine individual images into a time-lapse sequence the best program I have found is adobes After Effects. IT supports several dozen modern formats and has the ability to pan and zoom in large images.

I use several of these cameras in the lab to record timing of events, that is I will let a digital camera run to check how long it takes a flower to bloom, and check for motion and insects. It is quick and easy to set up.

# Other Interesting Things to look at:

Flat bed scanners can also be used to take time-lapse pictures of suitable subjects.

By creating a program which takes a scan and saves the resulting image to a file, a regular flat bed scanner can be used to acquire time-lapse images. There are two problems with this technique: the scanner has great registration side-to-side, but very little registration top-to-bottom. This means that the a movie made from a collection of scans appears to jump up and down due to the scanner not registration the image in exactly the same place on each scan. The image is rock solid left to right due to the scanner moving on rails along this axis.

To over come the registration problem, a software program needs to clip each scan in reference to a set target predominately glued to the top of the scanner.

This use of flat bed scanners is limited to flat objects like beans sprouting on the glass surface, mold growing, and crystals growing.

The bottom line here is there are a lot of interesting ways to acquire images that can be used in a time-lapse movie. Go out and experiment with all this new technology, think about how you can use all this standard equipment in new and interesting ways - Have fun, and most of all - send me a note when you find something cool.