

GUIDE TO PHOTOGRAMMETRIC STEREO PHOTO ACQUISITION

Nick Russill – www.terrageomatics.com

REMEMBER TO TURN OFF AUTOFOCUS / FOCUS ON ∞

When your lens and camera were calibrated using PI-Calib, it should have been set to manual focus at infinity. It is a good idea to tape your lens focus ring to this position to avoid the chance of accidentally moving it by hand (which nearly always happens). Many people ask how it is possible to get the subject in focus if the lens is set to infinity? The answer is *depth of field*. This is the additional area that is in focus in front of and behind the subject. We can control depth of field with the lens aperture (or iris – like the eyes). The smaller the aperture the greater depth of field. Wide angle lenses (24mm or 28mm) are excellent because they have very long depths of field. For example a 28mm lens set focused to infinity at an aperture of f/22 (the smallest) will have everything from around 1.5m to infinity in nice sharp focus. A great resource where you can print out a table of your camera / lens and depth of field at different apertures is www.dofmaster.com.

SET THE CAMERA MODE TO (A)erture Priority

This is how we control the iris or aperture in order to maximise depth of field. If you use the dofmaster.com tables you can see that it is actually possible to use wider apertures (e.g. f/11) and still have your subject in focus when the lens is fixed on infinity. Controlling the aperture in (A) mode is nearly always done with a finger or thumb wheel somewhere on the right hand side of the camera (see figures below). Normally it is necessary to partially depress the shutter button in order to control the aperture. Once set, the aperture should remain on this setting until you change program or change it manually.

If you find it necessary to photograph a subject that is very close and need to use a very small aperture in order to achieve the desired depth of field and do not find it possible to use a tripod, another way of getting a shutter speed suitable for hand held work is to increase the ISO.

CHECK THE ISO SETTING

The ISO is the setting that controls the sensitivity to light of the digital sensor. It is exactly the same as the “fast” or “slow” film speeds that characterise different films on film cameras. It is important to remember that increasing the ISO also increases the amount of noise (like film grain) in the images therefore an optimal setting needs to be chosen to suite the aperture, focal length, shutter speed and ambient lighting.

On most digital cameras ISO 200-300 is a good choice. Digital noise at high ISO settings (or rather lack of it) is one of the reasons why higher end digital SLRs are more expensive, however if your work is going to be in low light situations, or applications where fast shutter speeds are needed (e.g. aerial work) then this should be a consideration.

CAMERA POSITIONING

Once you have established your optimal camera separation (using the B/H ratio referred to below), it is important to plan your camera positions. Remember that PI-3000 can only model COMMON PIXELS that are present in both the left and the right photos of a given pair so if the camera is angled inwards, or part of the scene to be mapped disappears when you move from left to right you need to consider a different viewpoint, move in closer or include another pair of photos to fill in the missing data.

The separation of the two camera positions in the stereo pair (called the base length) is a function of the distance from the target (referred to as the height). We are looking for a B/H ratio of 0.2 - 0.3 ideally. Imagine that you are 10 metres away from your target. What should the camera separation be?

(H)eight = 10m
(B)ase = ???
Result ratio = 0.3

Therefore to achieve the result we apply the formula: $B/10 = 0.3$. i.e. $B = 3m$

You can pace out the distance from the target or use a tape or disto measurer. Practice and plan each of the camera positions before taking the images. This is by far the most important part of the survey process – remember garbage in = garbage out!

USE OF TARGETS

You can dramatically increase efficiency at the image orientation stage by using circular targets of a size to suite your scene. Use of the auto-ellipse centre detection process in PI-3000 makes target definition very easy and far more accurate. If you don't have targets then you can still use any visible point feature such as a stone, paint mark, corner etc that is visible in each photograph of the stereo pair.

TIP: remember the centre mouse button for auto-correlation of target picking in the orientation screen.

USE A TRIPOD

It is sometimes said that “your sharpest lens is your tripod.” Use a tripod whenever possible – camera shake can occur even at supposedly safe handheld shutter speeds of 1/60 second. Camera shake is even more of a concern if you adopt the small aperture (f/22) approach of maximising depth of field. For very long shutter speeds, use of a cable release can minimise camera movement due to pressing the shutter. (NB it's ok to use a flash).

TIP: take two or more shots at each camera position to allow to insure against any errors due to camera shake, exposure problems etc.

GET FAMILIAR WITH YOUR EXPOSURE COMPENSATION SETTING

The best light for photogrammetry is often on overcast days where extreme contrasts between light and shadows are less of a problem. Remember that if parts of your images are in shadow (too dark) or bright white (too light) then the image processing

may fail in these areas. Plan the timing of your photography to take into account the position of the sun and maybe return at different times of the day to capture different elevations of a building for example.

A way to avoid over or underexposure is to use exposure compensation. This is a way of overriding the camera's automatic exposure which aims to find an optimal setting for the whole scene. For example where your scene contains a lot of sky you could overexpose the image to get a better exposure on the target, If the sky is blown out and overexposed it does not matter as this is not part of your photogrammetric model. Most cameras have an automatic setting called <exposure bracketing> which takes 3 shots each with different exposures settings so you can choose the best one.

POST PROCESSING:

It is sometimes desirable to improve the aesthetic appeal of an image by applying some post processing in a photo editing package such as Adobe Photoshop or PSP. The most common quick fixes include (a) exposure levels and (b) unsharp mask. Some cameras have picture programs to produce pleasing results straight of the camera. The new generation of Nikon DSLRs are best, followed by Canon's 400D or upwards. Ironically the high end professional digital SLR cameras produce the worst images in terms of softness and colour when compared to the same scene taken with a cheap point and shoot compact however once some post processing is applied to the pro images there is no comparison. Shooting RAW is another way to get the best results, but this is a more complex and time consuming process beyond the scope of this quick guide.