Panoramas (photo-stitching) – Part 1

T.O.M.S.

This trio of articles is something of a departure for us. Firstly, it's a brand new topic for the AVLine CD (you read it first here folks...). Secondly, previous subjects – sooner or later – had become relevant to our business lives and have either significantly enhanced the product or, at the very least, helped us to do the job.

That was simply 'pay-back' but, at this early stage, we aren't sure what value this new topic will be...

Never mind about all that – *it's great fun!* So in the hope you get the same degree of enjoyment, here's Part 1.

Photo-stitching

When taking photographs, film or digital, very often we hit inherent camera limitations.

For example, although some digital cameras have a 'Panorama' setting which seemingly allows you to capture wider-than-usual images, we understand this is not actually the case – all it does it to crop the top and bottom of the image, giving a pseudo-widescreen effect.

But we can almost certainly achieve the same result, probably more effectively, by post-processing digital images through computer software.

So for the moment we'll assume the camera will produce standard-format views, the aspect ratio being the normal 'landscape' 4:3 (or 3:4 if rotated through 90°, capturing images in the 'portrait' format).

However, the field of view is then limited to the maximum viewing angle the camera lens can achieve. Extra wide-angle ('fisheye') interchangeable lenses are of course available, but these are generally *very* expensive (£500-£1,500!).

In any event, in practical terms. they will be limited to 60-90° view angles.

But wouldn't it be nice if, literally faced with a stunning and jaw-dropping panoramic view, we could record that – as a *single* image?

Secondly, what happens if because of physical constraints you simply can't photograph the full image, despite the use of a wide-angle lens?

Trying to photograph a high building? Tricky if other buildings etc stop you backing away from your subject. This is the "What darn fool put that river there?" syndrome (yes, it does happen).

In all these cases, we can solve the exposure limitations by using computer application 'photo-stitching' software, in post-processing, to blend multiple images together to produce a genuine 'panorama' view. These can come in different guises:

– **Horizontal**. Using "panorama" in its conventional sense, multiple images (normally 4:3 aspect ratio), overlapping in the horizontal plane, are blended to produce a single, extra-wide image. The natural limit is 360° and, as we shall see, this is achievable.

– **Vertical**. Multiple images (aspect ratio either 4:3 or 3:4), overlapping in the vertical plane, are blended to produce a single, extra-tall image. Although the natural limit is more than 180°, in practice its use is probably limited to, say, depicting a tall structure such as the Post Office Tower.

– **Matrix**. If due to physical constraints it simply isn't possible to capture the full height *and* full width of the subject, overlapping multiple images can be taken in both the horizontal *and* vertical planes and blended, in both axes, as a matrix. This is an effective workaround – and very much cheaper than buying a fish-eye lens.

Software availability

When it comes to selecting and obtaining photo-stitching software, PC and Mac users are spoilt for choice. It's much easier for users of the RISC operating system – there's a wide choice of one...

We don't propose to review lots of packages in these articles, nor aim to recommend any particular one, so we'll limit the discussion to just three typical solutions: the one for RISC OS, a 'so-so' package for Windows and another for Windows which (subject to trial-and-error, pre-processing where necessary and often a deal of patience), can produce outstanding results.

'PhotoStitch' for RISC OS

John Pearson's *PhotoStitch* is a freeware programme, for RISC OS, and is available for download from his website at *www.westcairn.net*

It's very easy to use and, whilst limited to horizontal panoramas and using deep sprites (though other bitmap formats can be imported if *ImageFS* is running), in principle it can do the job quite well.

It's fair to say this is a 'semi-manual' process. Initially, once imported, the images are arranged roughly in the horizontal plane by *PhotoStitch*.

It's then necessary to select an image, manually identify and mark a suitable reference point towards the bottom of the shot (which must also be evident in the neighbouring image), then mark the *exact* same point in the adjacent image, then repeat the actions for a common, identifiable point towards the top of the same two images. These manual actions are repeated for all further images, before automatic processing.

The programme blends or 'stitches' each adjacent pair of images together, scaling and positioning them depending on the pairs of reference points, and then adding a modicum of blending to each join point.

In our (frankly limited) experience of *PhotoStitch*, the accuracy of the actual merging is often variable, sometimes for reasons which aren't immediately apparent.

However, as we look in more detail at the other two packages, it becomes clear that many factors which can affect the results are most likely common to *all* titles (not just the three considered here), so we'll discuss these elements at some length in Part 2.

What is evident is that applying the same factors to using *PhotoStitch* will certainly improve the results – so don't hesitate to try them out.

'PhotoStitch' for Windows

The same name and the fact that this particular title also comes 'free' is purely coincidental. It is for Windows *but* – to get it – you have to buy a Canon digital camera!

This raises a more general point about 'bundled' software, especially for PCs. Your typical Windows-knocker will complain bitterly about installation CDs loading supplementary software onto your hard disc – often without the option – and will probably curse and use inappropriate language about "bloatware"!

We take an opposing view. Responsible software houses will not load up your hard disc with rubbish and, even if they do, you can always delete it.

In our experience, this additional content of installation CDs very often contains some wonderful gems and, bearing in mind they come 'free' with whatever it is you've bought, it would be silly not to at least investigate what they are.

In practice, some of our favourite titles have come in by this route, often unannounced and, in effect, FOC. For example, when we installed *OPW* (David Pilling's splendid Windows port of *OPro* for RISC OS), it came bundled with *DPScan*.

This is a much-used application which very quickly has become one of our favourite titles for Windows (see the blurb and shameless 'plug' in the article on *Video to DVD*, Part 5, pp6-7).

By the same token, the Canon installation CD for our digital camera included not only the necessary Windows/Mac drivers and user-guide, but (among other goodies) a very neat file-viewer facility – and '*PhotoStitch*' – all effectively FOC. Are we complaining? No we are not.

In principle, *PhotoStitch* for Windows does the same job as its namesake for RISC OS, but is very much an automated, sit-back-and-wait application. The general procedure is:

– Select the images required for the panorama from the thumbnails displayed in the relevant directory viewer and click on Open, which loads them into *PhotoStitch*.

– Sort/re-arrange the loaded images (only if necessary; rarely required).

– Click on Merge and wait for the resultant panorama to [e]merge. It's quite quick; ten 6MP (megapixel) images will be 'stitched' within a couple of minutes.

– Crop the composite image as required. (The 'raw' panorama, formed from multiple images, will never be perfectly rectangular, so the top/bottom and/or the left/right edges can be cropped to suit, before saving; to be discussed in Part 2.)

– Save the result. In *PhotoStitch*, this will be a high-res image. For a horizontal panorama, for example, the final height will be the height of the underlying images from the camera, less any top/bottom cropping; the width will reflect the total of the blended, overlapping images, less any left/right cropping.

Easy or what? Initially however, the results were quite disappointing, with significant boo-boos, visible joins, 'ghosting' (see Fig 1) and suchlike.

Fig 1 Example of 'ghosting' (Canon PhotoStitch)

So, as another application had been recommended to us, we put *PhotoStitch* (for RISC OS and Windows) to one side.

However, we must stress it would be quite premature to dismiss these applications (or any other similar freebies). If the many 'tweaks' we subsequently deduced for use with the *third* title are applied to *PhotoStitch* – for RISC OS or Windows, or to any other bundled software you might already have – the significant improvements may mean you will find *PhotoStitch*, or its freebie equivalents, will do the job you want. So do give them a try.

PanoramaPlus 2 (for Windows)

The *PanoramaPlus 2* package we bought was an upgraded version of the title recommended to us and was obtained by post from Serif for £32.95 inclusive (*www.serif.com*).

Operation is very similar to *PhotoStitch*; the first three actions listed earlier are identical but initial processing is noticeably faster.

This is because the resultant panorama is *not* a full-resolution version but (seemingly) little more than a relatively low-res 'thumbnail' image, around 200 pixels high. The reason for this is not stated but we deduce that, maybe intentionally, it's an interim 'rough cut' to enable us to assess whether there are any significant faults and whether it's worthwhile proceeding further.

For example, any obvious boo-boos may be due simply to images having been selected and loaded in the wrong order, which is easily done, and just as easily righted by shuffling them around by drag-and-drop.

Secondly, evident joins may be due to significant exposure differences between two adjacent images which, again, can be put right at this stage by image pre-processing.

Thirdly, this is the time to crop the composite image to remove any 'higgledy-piggledy' edges, leaving a perfect rectangle for final processing (more on that in Part 2).

Once you're happy with the relatively low-res panorama (which in itself may well be adequate for your purpose, e.g. dropping into a DTP document, e.g. Fig 3), you can if you wish proceed to rendering a higher-res version by clicking on the Save icon and then on the Change Size button. This gives three options (Fig 2):

– A desired Width can be entered (in pixels); the height will automatically follow suit.

– A desired Height can be entered (in pixels); the width will automatically follow suit.

– Clicking on Optimum Size will automatically select the high-res version of the rectangle.

As with *PhotoStitch*, for a horizontal panorama, the final height of the Optimum Size option will be the height of the underlying images, less any top/bottom cropping; while the width will reflect the total of the merged, overlapping images, less any left/right cropping – and can be *very* large... (Fig 2).
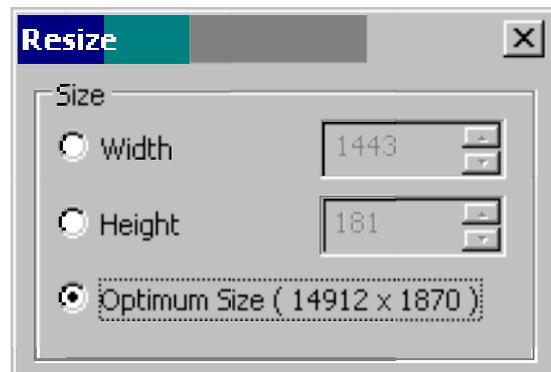
Fig 2 PanoramaPlus 2 Resize box

This is a good time to make tea, walk the dog, do the weekly shopping, etc, as *PanoramaPlus 2* takes a very much longer time to process the hi-res panorama; e.g. up to 40 mins to render, say, 20 images from a 6MP camera.

But it's a pure number-crunching task and there's a progress counter displayed just under the Resize window (Fig 2), so you aren't left wondering if it's crashed or whatever.

The extra time (and, presumably, the effort) is well spent however, as the resulting, high-res panorama is consistently better and with far fewer evident hiccups than that output by *PhotoStitch* (RISC OS or Windows varieties) – using the identical source images – but, nevertheless, *PanoramaPlus 2* is not without its problems.

This is where the extra effort in applying all the ideas we'll deduce in Part 2 – including camera settings, capturing images and post-processing – really can pay off.

In practice, provided we apply these ideas (which can be quite time-consuming in themselves), *PanoramaPlus 2* can render near-perfect results, all the way up to producing full *360°* panoramas.

As proof of that, we've included a few demo panoramas on the AVLine CD for your inspection and – hopefully – interest, all described in Part 3 and with a *'Heartbeat country'* theme (North Yorkshire Moors).

'Fish-eye' effects

Recalling that, in effect, another way to reproduce such images is by the use of a *very* expensive, wide-angle lens, we can clearly see in some of the demo panoramas where relatively straight objects *apparently* become curved, to a greater or lesser degree.

This is the 'fish-eye' effect, partly evident in the *Scarborough* panorama, but far more so in the *Goathland* image where the evidently 'curved' road shown in the foreground of Fig 3 (from a 180° view) is, in real life, dead straight. The camera does sometimes lie!

File handling

Although a thoroughly enjoyable, 'fun' exercise, playing with panoramas can stretch your computer's resources to their limit, and not just in rendering times.

If, say, we go for a full 360° panorama produced by blending ('stitching') 24×6MP images, and then select the Optimum Size option when saving the result – as we did with the *Scarborough* demo – we finish up with an awfully big 24-bit image; would you believe *c. 22,000×2,200 pixels?!*

When saved in the default TIF format, that's a 170MB file... Even if converted to a JPEG (accepting a slight further loss of detail from the source JPEG images), that still gives a filesize of over 16MB. So lots of RAM and a big hard disc drive do help. But then again, the £500-£1,500 saved on not having to buy a fish-eye lens will get you a pretty powerful PC...

T.O.M.S., toms@ndirect.co.uk

Fig 3 Apparent curvature of straight objects due to 'fish-eye' effects