BRIEF REPORTS

GigaPan panoramas for rock art panel documentation: a practical guide

By ROBERT MARK and EVELYN BILLO

We have been using super-high resolution stitched panoramas (GigaPans) since 2009 to document rock art panels. These panoramas permit zooming in from the entire panel to minute details (Fig. 1). Full-zoom resolution matches the resolution (or half the resolution: see stitching discussion below) of a single telephoto image. Basically, this requires a robotic pan head, a DSLR camera, and the associated stitching software.

Model	Weight	Max. camera weight	Batteries
Epic	1.4 kg	0.7 kg	6 AA
Epic 100	1.6 kg	1.4 kg	6 AA
Epic Pro	3.3 kg	4.5 kg	NiMH

The robotic pan head is currently available in three models, which accommodate small digital cameras, medium size DSLRs, and large DSLRs respectively. For details and a list of compatible cameras, see *http://gigapansystems.com/compatible-cameras.html*.

In our opinion, despite its advantages (NiMH battery, electronic cable connection to camera) the weight of the Epic Pro may make the Epic 100 (with solenoid to activate camera) a better choice for fieldwork.

We are currently using the Epic 100 with a Nikon D5000 DSLR and 200 mm lens. We use lithium AA (not rechargeable)

Figure 1. *White Shaman panel, south central Texas, U.S.A., with progressive detailed views outlined in red rectangles. This GigaPan can be viewed online at http://www.gigapan.org/gigapans/39160/. Select* Launch Full Screen Viewer.

Figure 2. *GigaPan robotic panhead in the field, Sears Point, Arizona, U.S.A. Photographs by Jennifer Huang.*

batteries, which will generally last for several panoramas. The batteries do, however, die quickly, and it has proven to be impossible to replace them without moving the pan head. For this reason, we have constructed an external battery pack to permit battery replacement during a panorama. A sturdy tripod with ball head is also used. Figure 2 shows the setup.

The procedure for shooting a panorama includes calibration for the lens (once), and selecting the upper left and lower right panorama area. The Epic displays the number of rows and columns (write these down for easier processing). Typically one to 300 images are used. Usually, aperture priority with high f-stop (greater depth-of-field) is used with fixed focus. If autofocus is necessary, a camera delay option setting will provide extra time for focusing. If focusing fails, however, the image may be skipped. Stitching requires a rectangular array, with no missing images. In general, a fixed exposure setting is also used. If the lighting varies during the panorama (such as passing clouds), dark and light streaks will appear in the panorama. Sometimes we experiment with auto exposure and/or focusing, but we find that, if possible, these should be avoided. White balance should be set appropriately, and definitely not on automatic.

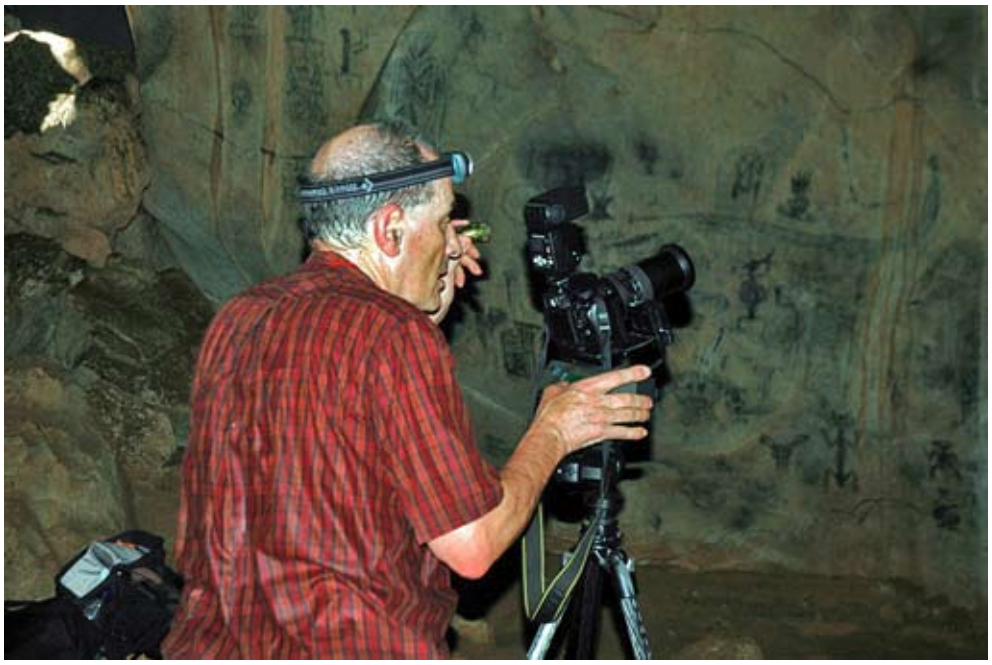

Figure 3. *GigaPan setup with flash in Hoyo de Sanabe cave, the Dominican Republic. Photograph by Domingo Abréu.*

We have recently developed a procedure for shooting GigaPan panoramas in the dark zone of caves. In this case we used a Nikon SB-600 Speedlight flash, set to manual mode (Fig. 3). A high camera ISO (3200) permitted a high f-stop (16–22) and low flash power setting (1/8

to 1/16). These settings permitted the acquisition of four GigaPans with one set of lithium AA batteries in the flash unit.

A lower ISO would reduce image noise but may require additional interval time to recharge the flash. This trade-off needs further testing.

After the images are acquired, they are loaded into the GigaPan Stitcher. The number of rows must be specified (by trial and error if not recorded in the field), and must result in a rectangular array (Fig. 4). The options include half-resolution, which we often use to limit the size of the file. After stitching (and optional uploading to GigaPan server) the image may be exported as a TIFF file. If the image is too large, a RAW export may be required. After processing in Photoshop, the image may be saved as a JPEG (30 000 pixel wide limit; resize if needed) or exported with Zoomify as a web application. We have discovered (and repeatedly reported) a stitcher bug that caused rectangular objects (e.g. mug boards, IFRAO Scale) to be improperly rendered.

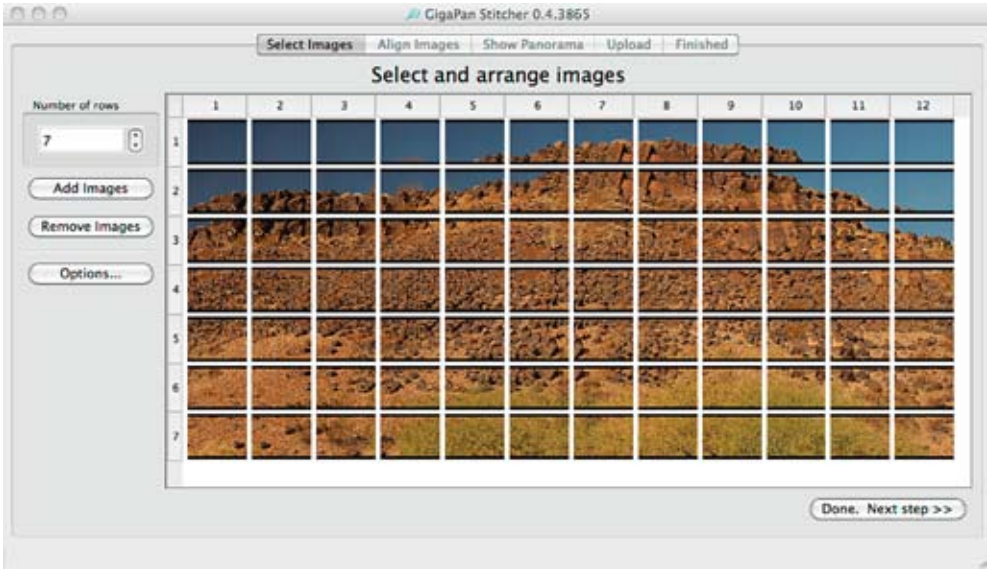

Figure 4. *Array of images in the GigaPan Stitcher, prior to stitching. A full rectangular array is required. This is a very small example; arrays of several hundred images are possible. Stitching may take a few hours. This GigaPan of Sears Point may be viewed at* http://gigapan.org/gigapans/36254/.

Figure 5 shows a panorama from the dark zone of a cave in the Dominican Republic. Links to this and other uploaded rock art GigaPans can be found on our home page: *http://www.rupestrian.com/*. Be sure to select *Launch Full Screen Viewer*. Zooming and panning is supported in Photoshop, in Zoomify, as well as within the GigaPan server web interface.

Acknowledgments

We thank Daniel DuVall and Domingo Abréu for their assistance in the caves of the Dominican Republic.

Dr Robert Mark and Evelyn Billo
Rupestrian CyberServices
3644 N. Stone Crest Street
Flagstaff, AZ 86004
U.S.A.
E-mail: *rockart@infomagic.net*

RAR 28-0000

Figure 5. *GigaPan image from twilight zone of Hoyo de Sanabe, Dominican Republic. This GigaPan can be viewed online at* http://gigapan.org/gigapans/69509/. *Select* Launch Full Screen Viewer.