EM3D – Building a 3D Camera

by Max Pow

Max Pow is an Auckland, New Zealand based member of the Sydney Stereo Camera Club (SSCC). Max was one of the first club members to use David Stuckey's 1999-2000 series of articles to build an Olympus XA twin rig. Max reported on his Olympus XA project in 3D Window No 151 (July 2000).

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I have often dreamed of having a really good 3D camera with modern optics that is easy to use, without the need to transfer exposure-setting calculations from a separate exposure meter. I had heard of a German firm, RBT, joining up modern cameras and this is surely the way to go. But in typical fashion I chose to go down the difficult path naively thinking it would be quick and easy.

Whilst surfing the Net I came across a Web site showing photos of a stereo camera built by Andreas Petersik in Germany, from two Nikon EM camera bodies cut, glued and screwed together. He called it an EM3D camera. I became interested in this and decided to give it a try, being a bit of a do-it-yourself person.

Looking through various second-hand photographic shops I managed to buy a couple of Nikon EM cameras quite cheaply. Many months later thanks to many E-mails I had gathered a fair amount of information on how to do the various linkages required within the 3D camera body.

I was still reluctant even then to go ahead and actually cut two Nikon camera bodies but eventually I plucked up the courage. I was pleasantly surprised to find that beneath the plastic covering is a well-made camera built using metal parts, chassis made from high quality casting metal of copper-selenium- aluminium alloy. I photographed the electronic wiring with a digital camera, this turned out to be very prudent when I finally reconnected the wiring. Also I wrote down notes and drawings along the way.

Jukka Lehtonen of Finland, who had seen an email message I had left on the SSCC web site, offered to send an electronic copy of the EM service manual, which I gratefully accepted.

The camera took a year to build and another year to sort out the problems. I nearly gave up a couple of times but persistence paid off and I was able to complete the project.

The Agony:

I first had to work out exactly where to make the cuts having decided on 75.5mm spacing; this was determined by wanting full frame 8-perf size images and greatly helped by Andreas' photos. Having made the cuts not quite to the line (Fig. 1), I used my engineering lathe to true up and obtain a good finish for each piece.

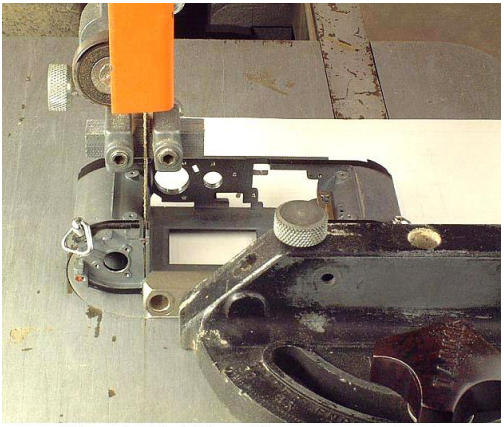


Fig. 1: Cutting the camera body

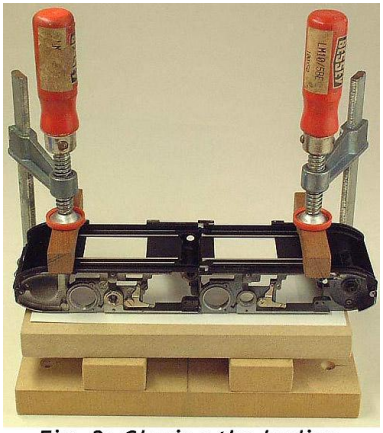


Fig. 2: Glueing the bodies

After testing some epoxy-resin glues I found Araldite Super Strength was most suitable. A jig was made to allow for precise glueing. A dry run was made clamping the bodies to the jig and using a straight edge to align the film guides to make sure all was okay. I then glued the bodies remembering to put paper between the jig and bodies to avoid the jig sticking to the camera body (Fig. 2).

The 3-1-3… winding mechanism needed a specially cut 4-toothed gear mounted to the 2mm thick brass linkage bar. Two leaf springs are used - one to prevent the gear from turning backwards when the mechanism is returning after a wind, while the other leaf spring stops the gear from rotating while it tensions the mirror spring. The 4-toothed gear was made from silver steel and then blued by heating and plunging into water creating a slightly hardened skin. I had six goes at making the brass connecting linkage bar and three for the 4-toothed gear before I got it right (Fig. 3).

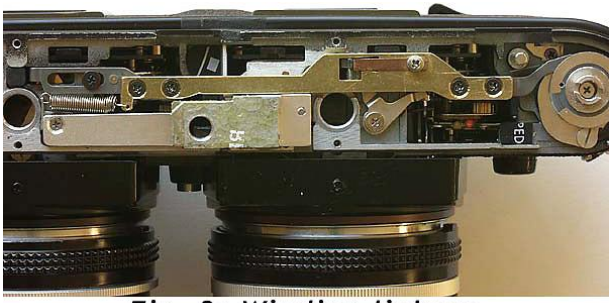


Fig. 3: Winding linkage

Next came the mechanical shutter linkage using stainless steel, a tricky mechanism that took a lot of effort, 12 attempts before it would work correctly. Halfway through trying to get the mechanism to work I wondered if I would ever have a working 3D camera. The trial-and-error was somewhat frustrating.

It is basically a double linkage system incorporating a tension spring and adjusting screw. The two solenoids were electrically connected together, these being controlled by the on-board computer for timing the exposure. I was able to adjust the shutter synchronising to better than 1/8000 of a second (Fig. 4).

Fig. 4: Shutter linkage

The mode switches were now coupled together. I used 0.3mm stainless steel for this, as it had to fit between the shutter and the chassis with barely enough room. The shape and cutouts for this linkage had to be reasonably precise to work properly and it took six attempts to achieve this.

It was not practical to have both mirrors operating so the left hand mirror was fixed to the up position permanently by reversing the fly-back spring. The left-hand pentaprism was removed.

The front panels were cut and joined by a piece of 2mm brass, glued and screwed. Next I screwed the front panel to the chassis and checked alignment, lens flange to film plane. Shimming was required to optimise the alignment.

A small plate of 2mm brass glued and screwed joined the cut camera backs. Care needed to be taken to avoid the back curving outwards when closed as this would let light in. The plastic base cover was altered to allow for the 3-1-3 winding mechanism by cutting out parts of the cover and then covering the base with specially shaped thin plywood.

Places that required painting, joins and modified covers, were sprayed with a black metal primer followed by black Super Enamel.

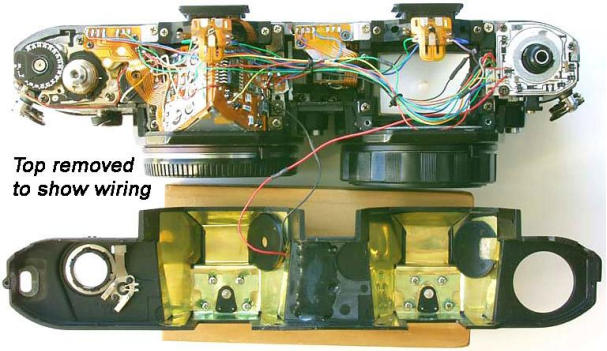
I did a couple of modifications to the original Nikon design. The button that increases the exposure by 2 stops for backlit subjects was altered to hold the exposure measurement while re-aiming the camera. I disconnected the Nikon flash sensing to the left-hand accessory shoe; this allowed me to use the flash if I did not want the camera to self adjust to $1/90^{th}$ sec.

Due to inconsistent exposures, it took some considerable time shooting quite a few films to solve this. I changed the silver oxide batteries to lithium as I thought the former were not supplying sufficient power. It turned out to be the memory switch that needed readjusting as the memory was taken as the mirror was moving rather than just prior to the mirror moving.

A wooden ‘gripper’ was made to house the batteries and make for easy handling, as the camera is rather heavy and cumbersome to hold. I mounted a metal bracket centrally located to the underside of the gripper, threaded for tripod use (Fig. 5).

Fig. 5: Camera gripper & battery holder

There was some filling required where the bodies were joined; I used Araldite epoxy glue mixed with very fine metal filings – the glue was held in place using masking tape to create walls preventing the glue from running away. In some places I mixed charcoal with the epoxy, creating black opaque glue. All the sticky foam (why they can't use a material that's more permanent I do not know) was replaced with black wool yarn placed in the channels the camera back engages to when closed. Once everything had been tested and all worked satisfactorily the imitation leather was glued back on.



The lenses:

I decided to use two manual Nikkor Zoom lenses 28–85mm that I obtained from B&H New York via the Internet. Coupling the focus, f/stop, and zoom adjusting rings had its own set of problems. I did not want to drill holes etc. in the brand new lenses so brass straps covered with rubber lens grip material from a throw-out video lens were made and wrapped around the focus barrels and zoom rings. Each was linked with adjustable rods. For the f/stop linkage I used the screw holes holding the meter-coupling bracket, used for very old Nikon lenses, and again linked with an adjusting rod (Fig. 6).

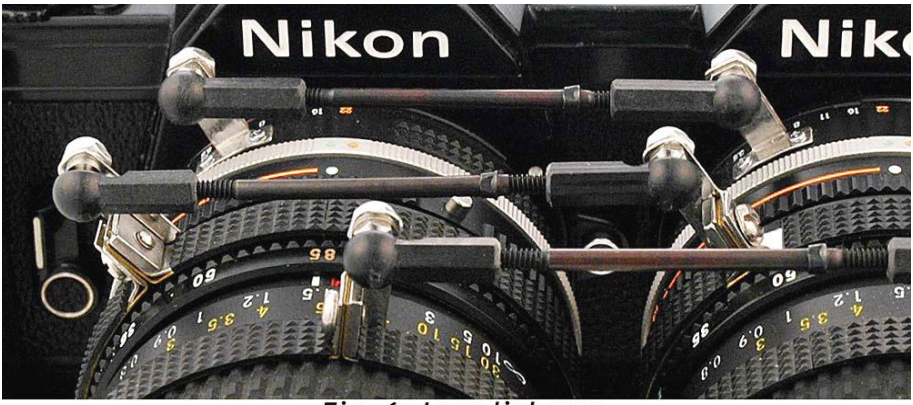


Fig. 6: Lens linkages

Camera Information:

The Nikon EM camera uses a shutter triggered mechanically, the 1st curtain opens, a solenoid holding the 2nd curtain back until the correct time has elapsed, and then the second curtain is released terminating the exposure.

The camera is manual winding; the mode switch selects "B", 1/90sec and Auto. The shutters are Copal with flash sync up to 1/90sec shutter speed. Shutter speeds for Auto from >4sec to 1/1000sec. Lens spacing is 75.5mm taking 18 pairs on a 36-exposure film.

The Ecstasy:

The completed camera including lenses weighs 2.5kgs. Most importantly it works very well and gives me great results! I have only myself to blame for any poor photos that maybe taken.