

# Reflections on Domes

by Pete Atkinson

I must be an anachronism. It's a danger with increasing age; the world shifts and your world-view gets out of kilter with reality.

Thirty years ago I was struggling with domes for home made-housings; where to source them, where to place them in relation to the lens, how to get the best results. I ended up with hemispherical cast acrylic compass domes, with coated, custom- made plano-convex dioptres in obscure strengths, +2.4 for the 8" dome, + 3.3 for the 6" dome. On film, viewed with a loupe, this looked pretty good. Not as good as the Nikonos 15mm lens which, at that time, was the benchmark all dome systems were measured against.

And then along came digital. 100% on a good monitor is very unforgiving. So I can't say for sure whether modern domes are better, or only that they don't feel better when examined with brutal clarity on a monitor.

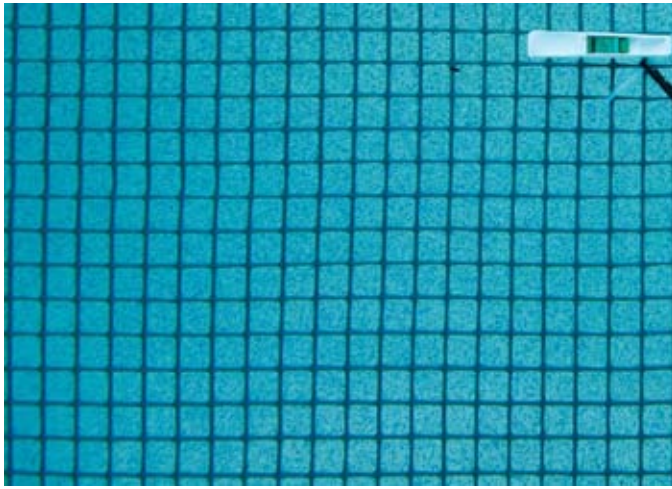
Here's a plea to all retailers of domes: put a full size section drawing of the dome on your websites. A photo of a dome tells you about as much as a photo of a pane of glass. Most photos are not clear enough to tell how much

of a complete hemisphere the dome is. A section drawing will clear this up. It's not like we are spending \$50, so the least you can do is give us sufficient information to make sensible buying decisions. From the drawing we can measure the internal radius which is critical to determining the port extension. And while you are about it, tell us what testing you have done to justify your recommendations for different extensions. One major manufacturer suggests a shorter extension for the Sigma 8-16 than the Nikon 12-24, even though the apparent front entrance pupil of the latter is closer to the lens mount. That's fine; maybe they have a reason (like it vignettes the mount with a longer extension) but I want to know what it is. They might think that we

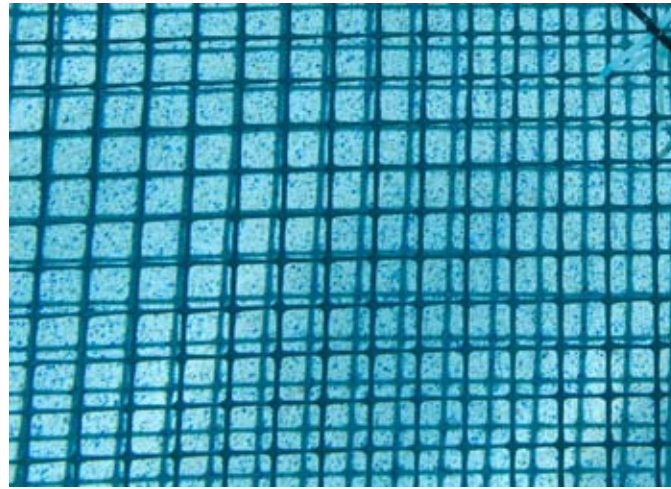
*(Top) A large dome makes controlling the meniscus easier for half and half shots and also makes it easier to encompass both above and below portions of the image within the depth of focus.*

*(Right) Pete Atkinson and Doug Seifert compare domes; size isn't everything... (Darin Limsuansub)*





*Sigma 8-16 rectilinear at 8mm, f11 and 1/125th. Seacam Superdome and 35mm extension. This shows the bottom left quarter of the frame (the peg is in the middle) illustrating the loss of sharpness into the corner even at f11. However, this extension is too small for this lens, 60mm would be better.*



*Nikon 12-24 at 12mm, f8, 1/250th with a B&W +3 dioptre, 20mm extension with the Seacam fisheye dome, showing a quarter crop. The cable ties to aid focusing are in the middle of the frame. The +3 dioptre reduces the field of view but improves corner sharpness with this lens.*

*Nikon F4, Sigma 15mm fisheye, home-made housing with hemispherical 8" cast acrylic compass dome. F11, 1/250th, Velvia 100. (I think)*



just need to trust their measurements and accept their extension recommendations, but I would prefer to check.

The elegance and sophistication of modern engineering should enable a variable port extension to be made, that can be set and locked at a range of lengths. A coarse screw thread could provide the axial movement.

Many modern domes are not hemispheres, but part hemispheres. In theory, a 180 degree fisheye needs a hemispherical dome, so that the light rays coming in at 180 degrees pass through the dome perpendicular to the glass. But as you may have noticed, fisheye lenses are very forgiving, producing excellent corner sharpness even when the apparent front entrance pupil is far closer to the dome than

the centre of curvature.

(If you want a refresher on apparent front entrance pupils, centre of curvature and measuring domes, see my dome article in issue 36 of UWP.)

The difficulties arise with rectilinear wide lenses like the Sigma 8-16 and the Nikon 12-24. Some section domes that are too small a section can be unusable, because with the centre of curvature of the dome placed at the apparent front entrance pupil of the lens, the lens is wide enough, and far enough behind the dome mount, that it sees aluminium dome mount around the edges, not just glass.

The Nikon 12-24 behind one 9" glass dome was very soft in the corners. In water, the camera needs to focus on an apparent image about three times the radius of the dome in front of the dome, but this image is curved. The degree of curvature is related to the dome radius; small domes have a tighter curvature of field. So at wide apertures, the corners simply fall outside the depth of focus if you focus in the middle of the picture. Adding a dioptre (a close-up lens) can fix this. However, you lose angle of view. So how much improvement is due to just not seeing the corners anymore, and

how much is due to optical effects, I don't know. I use Schneider B&W dioptres (a +2 or a + 3) which seem excellent and give a sharp image well into the corners with a 9" glass dome. The plano-convex dioptres I had made, in theory, reduced the curvature of field so that it was easier to include the corners in the depth of focus. In reality, the B&W dioptres were optically better.

With the Sigma 8-16, you can't use a dioptre on the front. So far, I haven't found a solution which gives good corner sharpness except by stopping down to f11 or smaller. With modern cameras which can shoot at high ISO, this isn't such a drawback.

You may well ask... What's the difference really, between a picture shot with a perfect system, and one shot with a system that gives soft corners. Not that much really... Except that some domes are almost unuseable without a dioptre. There are very beautiful books shot by great photographers 20 years ago that were full of pictures soft in the corners. Call it the "underwater vignette"! Non-divers may be guided to the centre of the picture by the soft vignette. Photographers only think, "Jeez! That 14mm doesn't like that dome..."

Mini domes have their uses. They work ok with fisheye lenses but the curvature of field is tight so corner sharpness can be an issue. They are cheap and light and easy to travel with. You can bring your strobes close in beside the dome for softer lighting on close-up shots. But they are very difficult to use for half and half pictures because the meniscus is hard to control. (I made up a 14" dome for these shots, and even that was hard to manage sometimes.) The best minidomes are probably those in front of the Nikonos 15mm lens and the Nikonos RS 13mm fisheye lens, but then the lens behind them is perfectly designed to work with them.

Acrylic domes are light and inexpensive but don't have anti-reflective coatings applied. Optically, they suffer from the image that they are less sharp than glass. Scratches however, can be polished out easily. Which is fortunate really, as they are easier to scratch. I use increasing grades of wet & dry abrasive paper used wet, up to 1200 grit, then Solvol Autosol metal polish. Brasso works too.

Glass has the best reputation. I don't know if it's deserved. Great optical coatings can be applied at some expense, but I have never seen a coated dome tested against an uncoated one. It's not hard to find examples of people with the most expensive glass domes who are still unhappy with corner sharpness.

One of the great things about glass, is that you can polish it with Rain-X (I can't guarantee it won't damage the coating!) so that water beads and runs off almost completely when shooting half and half pictures. You can use the marine version, which is alcohol free, on acrylic. RVR Rain Repellant is also free of alcohol and used for aviation. (Alcohol will cause acrylic, especially extruded acrylic, to craze.) I find a beading agent easier to use than a wetting agent like detergent or spit. With the latter, you are forever applying it, dipping the dome before every exposure and hoping you take the shot while the water is still adhering in a perfect monolayer. However, surf photographers use spit and even recommend letting the smeared spit dry! Also they dispense with dome shades, which prevents the shade dripping on the dome. Perhaps the shade is better off inside the dome! Lemon Pledge is another beading agent favoured by David Doubilet at one time.

Most people don't mind spending money on quality, but they need reassurance that they are

actually buying value. A standard test target shot in a pool a metre away at various apertures with the different lenses we use can't be asking too much, and would allow consumers to make realistic comparisons between domes. I used that stiff plastic garden netting with 18mm squares stretched over a PVC pipe frame for my tests. A universal target would make comparisons between different manufacturers easier.

Imagine if all available domes were tested with the camera on a motorised rail independent of the dome so that it can shoot video while moving the lens apparent front entrance pupil from behind the centre of curvature, through it, to in front of it, to determine the optimal placement for maximising the corner sharpness... Any volunteers?

Pete Atkinson



*Don't settle for 2nd best*



Film - No Filter  
No White Balance



Digital - No Filter  
Manual WB



Magic Filter  
Manual WB

Digital cameras have opened up new possibilities to underwater photographers. For available light photography manual white balance is an invaluable tool for restoring colours. But when you use it without a filter you are not making the most of the technique. You're doing all the hard work without reaping the full rewards.

These three photos are all taken of the same wreck in the Red Sea. The left hand image was taken on slide film, which rendered the scene completely blue. The middle image is taken with a digital SLR without a filter, using manual white balance. The white balance has brought out some of the colour of the wreck, but it has also sucked all the blue out of the water behind the wreck, making it almost grey. The right hand image is taken with the same digital camera and lens, but this time using an original Magic Filter. The filter attenuates blue light meaning that the colours of the wreck are brought out and it stands out from the background water, which is recorded as an accurate blue.

*[www.magic-filters.com](http://www.magic-filters.com)*