by Chris Garvey

A Moonfish Group

A state of complete unconsciousness would be the only excuse for us astronomers not noticing the explosion in William Optics products in recent years. That, and more recently, the great number of same product-badged clones that emerge from the same product manufacturers in Taiwan. Not that we're complaining, far from it, it's great news for those who can not afford the expensive choices around, and yet still hanker after well engineered and cosmetically beautiful refractors and associated equipment.

One such company that has embraced the opportunity to badge these products call themselves Moonfish. Dangerous ground for a reviewer weaned on Monty Python. Is the temptation too much to resist passing comment on the name? Should I make some lame joke? Having spoken to Ric at Moonfish (a pleasant and talkative Mancunian) he probably wouldn't mind. But that's exactly what you would expect me to do, so I'm not going to. It is worth mentioning though that the name Moonfish was conjured from a desire for a company name that was both distinctive and "World Wide Webby". In that I think they have succeeded.

The Moonfish Group is run principally by two individuals; Ric Capucho-Paulo based in Switzerland and Daniel Corredor Jiménez based in Barcelona. A truly modern European flavour to this company then and one that is based upon internet sales. A dealer network does not yet exist for this company's products.

Moonfish offer an 80mm ED refractor and several eyepieces and accessories, all chosen from the many now offered from Taiwan and China. The company has worked with the Asian

The Moonfish push fit dielectric 2" diagonal "arguably the most attractive of all 2" diagonals"

manufacturers to bring about improvements in products already existing, the current crop offering better finish and performance than the originals.

As the company is called the Moonfish Group, we thought we would review... well... a Moonfish group.
This particular group consists of the telescope (reviewed separately), a Barlow lens, an eyepiece and a star diagonal; a fair representation of the products the company offers.

The star diagonal.

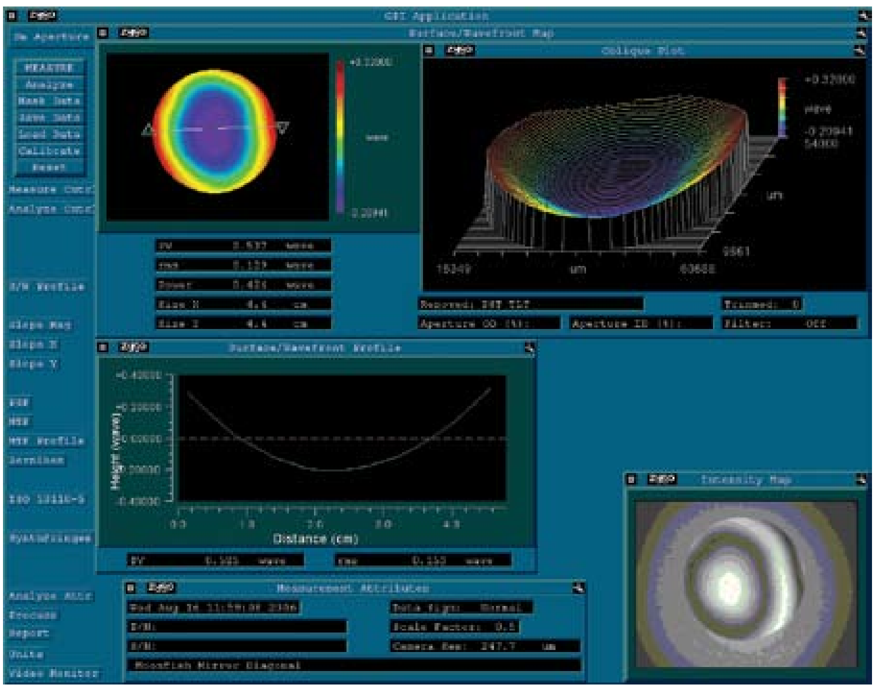
The 2” push-fit star diagonal appears at first glance, to be the same as the other 2” diagonals ‘cloned from those first introduced by WO’; a high gloss lacquer surface to the barrels, blemish free anodising, attractive finish to all parts with plastic caps to both ends. These Taiwanese diagonals are arguably the most attractive of all 2” diagonals, the attention to detail is very obvious. The thumb screws are high quality and a generous size for gloved hands, the 2” barrels at both ends have a gentle inset slope to prevent the eyepiece slipping out of the diagonal or indeed the diagonal slipping out of the telescope. Both the 2” eyepiece aperture and the 2” to 1.25” adapter have brass compression rings to prevent marking an eyepiece barrel, and the inside of the end of the barrel that inserts into the telescope is threaded for 2” filters. This particular diagonal is decorated with the Moonfish logo on both side panels. Should cleaning of the mirror surface ever be required, the removal of four screws on the bottom plate and a further two on the side plates allows the separation of the base section from the rest of the unit. For a brief burst of compressed air to remove surface dust only, the 2” barrel that slots into the telescope can be unscrewed from the main body.
The mirror surface is dielectrically coated rather than aluminised, a multi-layer coating that theoretically reflects a greater percentage of visible wavelengths than evaporated aluminium or over-coated evaporated aluminium. In comparison to two other aluminised diagonals; a Russian diagonal and a Synta 2” diagonal, used on the Moonfish telescope, a Skywatcher ED 80 and a Takahashi 210mm Mewlon, it was possible to claim a slight darkening of the background sky near the zenith and at lower latitudes with the Moonfish dielectric diagonal, with the complimentary increase in contrast of nebulous DSOs. The differences were small though, and there were no advantages noticed for planetary images, or higher power images of the moon. For deep-sky use though, considering the rather attractive price of £75/€119 (£79/€129 for the SCT screw-fit version), the dielectric version is highly recommended.

Interferometry

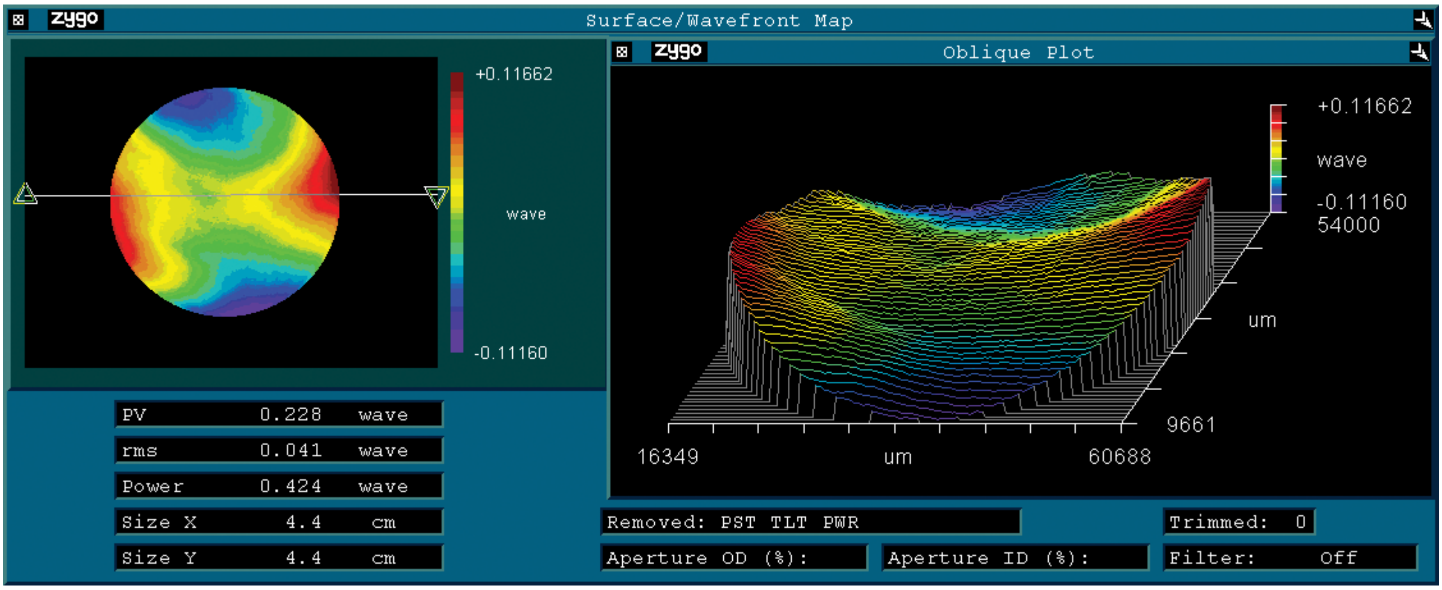
Testing a flat mirror at 45^{o} to the incident beam using a Zygo interferometer highlights two aspects of a typical star diagonal flat mirror.
1. A great many of them are not truly flat.
2. Because of this, any astigmatism the interferometer reveals can be surface astigmatism (figuring error or pinching), or apparent because the surface is not flat _and_ tipped with respect to the test beam.
The footprint of the test beam (*or indeed the footprint of the converging cone of light from the OG)* on the mirror will be elliptical. This means that the effects on an image from real surface astigmatism can be accentuated or attenuated depending on the orientation of the two astigmatic profiles as they appear under test, or with respect to the eyepiece and observer.

However, all is not lost. This potential complication can be side-stepped to a degree because the flat is used in a star diagonal. Confused?

Lets look at the interferometry results. The interferometer measured the 44mm visible diameter of the mirror and so the results are for that



Interferometry result on the diagonal (see text for explanation).



Interferometry result on the diagonal (see text for explanation).

diameter. The interferogram with Piston and Tilt removed but not Power (Removed : PST, TLT) demonstrates that the mirror has power, i.e. it is not flat. The peak to valley wavefront error at 632.8nm is a little more than 0.5 wave (1/2 wave). The RMS figure is 0.13 (approx. 1/8th). The P to V looks unimpressive but the RMS (the more important figure) is healthier. If we look at the second interferogram with Power removed as well, the P to V wavefront error improves to a little better than ¼ wave with the RMS at 0.041 (approx. 1/24th). This is better. However, we know the flat has power (it is not flat) so we cannot ignore this. Does this mean that the effect on the image from a telescope will be modified by a ½ wave flat? No. The flat is used as a star diagonal, which means it is placed close to the focus of the converging beam from the OG. So, only a very small area of the mirror is used. In most cases an ellipse of only a few millimetres minor axis. Remember an entire 44mm is tested. In real use a central area of the mirror only millimetres in single figures is used. The measured centre portion would result in error figures a mere fraction of that for the whole surface. Unless there is an obvious sharp error at the mirror centre or it is particularly rough, we don't usually have to worry too much about the quality of the mirror surface.

A little thought then provides the realisation that as the diameter of the cone of light incident on a diagonal from a long focal ratio instrument is small, the quality of a diagonal used on such an instrument need not necessarily be as high as that required for use

The Moonfish 2X 2" ED Barlow lens has a low dispersion element as part of the lens doublet

with a short f/ instrument. The diameter of the cone from a short f/ instrument incident on a diagonal will be larger and hence it matters a little more about surface quality over a greater area. The shorter the f/ of your telescope, the more you need to think about the surface quality of a star diagonal.
A little more thought results in the realisation that the surface quality of elliptical flats used in Newtonians need to be much better than those commonly used in star diagonals, because the whole or most of the Newtonian flat is filled with the light cone.
So, even though a diagonal flat may show a little power, or in this case, 0.468 wavefront error P to V of astigmatism. The RMS figure for astigmatism is 0.118 (a little over 1/9th). For the small area used by the cone from a telescope, this figure is reduced dramatically. The Moonfish Dielectric Star Diagonal tested then can be considered of high quality for its intended use. Thoroughly recommended.

Wish List

- For the money we are being asked to pay for this product, wishing for an improvement seems a little pathetic. Can't think of anything.

The Barlow lens.

The Moonfish 2X 2" ED Barlow lens is one of five Barlow lenses currently offered by the company, and the only 2" model that uses a low dispersion element as part of the lens doublet. A well made Barlow can help to reduce the apparent severity of image aberrations, a poor Barlow can introduce image degrading aberrations. A low dispersion element then sounds promising. Similar to the star diagonal, the exterior standard of engineering and product finishing of this Barlow is astonishing, particularly for the retail price of only £69/€105, and the first impressions thus favourable. CNC turned, smooth anodised surfaces, inset thumbscrews and a pimpled rubber grip on the top part of the barrel. Both the 2" eyepiece aperture and the 2" to 1.25" adapter have an inset brass compression ring instead of the old-fashioned simple screw system. Plastic caps are provided for both ends. The lens doublet is fully multi-coated. Measured dimensions are: Length – 116mm, Width (upper barrel) – 59mm.

With the Moonfish 2X 2" ED Barlow the focus position at infinity is closer to the OG (object glass (objective lens)) than is the focus position using an eyepiece alone. The knowledge of where a Barlow plus eyepiece combination comes to focus, is important when choosing a Barlow for a telescope that may be a little restricted for either in-focus or back-focus. A short list of the change in focus position of a few eyepieces is provided when used with this Moonfish Barlow lens.

Barlow with 5mm Monocentric focuses 11mm closer than with the eyepiece alone.
Barlow with 8mm Celestron X-Cel focuses 10mm closer than with the eyepiece alone.
Barlow with 30mm 2" Moonfish Ultrawide focuses 12mm closer than with the eyepiece alone.
Barlow with 25mm Taiwanese Plossl focuses 10mm closer than with the eyepiece alone.

Problem is, with these eyepieces and several others in conjunction with the Moonfish ED Barlow, infinity cannot be reached using the Moonfish ED 80 telescope and a 2" star diagonal. There is simply not enough back-focus when using the Moonfish 80ED telescope. When using a Dall-Kirkham, an SCT or even the Skywatcher ED80 there is no problem, just the Moonfish telescope. Odd, one of the first things for manufacturers to get right with accessories is to ensure that at the very least, they all work with the same brand telescope.
The 30mm 2" Moonfish Ultrawide eyepiece also on test, loses a measured 10% of the apparent field of the eyepiece when used with the 2" ED Barlow through vignetting. This is somewhat academic as the combination will not reach focus with the Moonfish refractor at infinity, there is a woeful shortage of back-focus here. 50 metres is the approximate furthest distance of focus this combination can reach. This does however open up possibilities for the telescope to be used as a long distance microscope. The close focus is around 4m. With

As with virtually all of the fittings on Moonfish accessories, careful thought has been given to the finish, including brass compression rings shown here on the 2X 2" Barlow lens.

an extension tube this may be reduced to below 3m. However, the common problem of close-focus spherical aberration would increasingly apply here, particularly if this refractor is corrected for minimum SA at infinity.

Unscrewing and then placing the lens element cell of the Barlow into the front end of the diagonal by screwing it in, gives an approximate 5X amplification instead of the designed 2X but does not introduce any objectionable axial or lateral colour, although a little spherical aberration takes the edge off image sharpness. So this method of using the Barlow is not recommended. Besides, this method requires an extra 300mm of extension (four extension tubes) to reach focus at infinity. Not a problem if you are a member of the Slightly Silly Astronomical Society.

The Moonfish website comments on the unscrewing of the Barlow lens elements section, and screwing this section into the bottom of a 2″ eyepiece.

'2x: Just put the Barlow lens into your telescope's focuser, then put the eyepiece into the Barlow lens.
1.5x: Unscrew the lower, black anodized part of the Barlow lens (the part holding the lenses) and screw it into the eyepiece like a filter'.

This idea is a common method of altering the amount of image amplification, and is common practise with the Celestron 2X Ultima 1.25″ Barlow and the TAL 2X Barlow, amongst others. This "fiddling" with the working distance of a Barlow tends to give better results with some eyepiece designs. To be more specific, it's not that it works better with some eyepieces, it's that its destructive effects on image quality are less with some eyepiece designs. Moonfish claim an amplification of 1.5X when used in this way. This was measured with the 30mm Moonfish eyepiece to be 1.65X by measurement of the angular field of view (taking into account the vignetted edge of the field). However, as with most Barlows, they are designed to work best at fixed image amplification, in this case 2X. At 1.65X with the Moonfish 30mm eyepiece, the apparent field is reduced by about 10% from vignetting, and the image quality is poor at a very short distance away from the centre of the field. The same amplification of 1.65X was found when screwed into a 2″ 42mm wide-field Kelner, with the same vignetting and loss in field flatness and image quality. Not good.

Let's see if something else works. The 2″ to 1.25″ adapter on the Dielectric diagonal has an internal thread the same pitch as the thread on the front end of the diagonal. The 2″ to 1.25″ adapter that comes with the telescope is not the same pitch, either that or the thread on this particular one has a problem. The Barlow lens housing section can be screwed into this star diagonal 2″ to 1.25″ adapter. This then can be slid back into the diagonal. For obvious reasons, only 1.25″ eyepieces can be inserted into this configuration. The 2″ to 1.25″ adapter that comes with the Barlow has an inset and is shallow compared to the other adapters, it is advisable ***not*** to use the Barlow adapter for the purpose described here.
With the diagonal adapter, of the eyepieces tested, the length of the barrels on the eyepieces bottom out before coming into contact with the lens element, however it is advisable to check whether this is true for your own eyepieces prior

The 30mm 2″ Moonfish Ultrawide is listed as being a five element eyepiece, the elements being in three groups and fully multi-coated.

to use, particularly if a 1.25″ screw-in filter is to be added as well. In this configuration the measured amplification is approximately 1.5X.

The Moonfish website also suggests that vignetting is not an issue with normal use of the Barlow, even with 2″ wide-angle eyepieces.

'The lenses have a diameter of 37mm, thus you can even use 2″ wide angle eyepieces without vignetting'.

At 2X normal use, the Barlow did not introduce vignetting with any 1.25″ eyepiece tested, but did with the 30mm Moonfish eyepiece and the 42mm wide-field Kelner. This was apparent with the Moonfish refractor, a 308mm Newtonian and the Takahashi Dall-Kirkham. The level of vignetting with long focal length 2″ eyepieces used with this Barlow will depend entirely on the design of the eyepiece, however, it is not objectionable with the wide apparent field designs as there is plenty of field anyway. There is vignetting with the Moonfish 30mm Ultrawide and the Synta 42mm wide-field Kelner eyepieces when the Barlow is used at 1.65X too. What about 1.25″ eyepieces when the Barlow cell is attached to the diagonal adapter at 1.5X?

40mm TAL Plossl – vignetting
30mm Celestron Plossl – vignetting
25mm TAL Plossl – no vignetting
25mm Japanese Orthoscopic – slight vignetting
25mm Taiwanese Plossl – slight vignetting
18mm Celestron X-Cel – slight vignetting
18mm Takahashi LE – no vignetting
12mm Nagler – no vignetting
10mm Taiwanese Plossl – slight vignetting
9mm – Japanese Orthoscopic – no vignetting
7mm – Pentax XL – no vignetting
6mm – Japanese Orthoscopic – no vignetting
5mm – Monocentric – no vignetting

So, the focal length of the eyepiece, its field lens diameter and the position of the fieldstop determine the presence and severity of vignetting when used with this Barlow. This of course is true of many other Barlow lenses as well.

The accessories that arrived with the telescope in the foam lined case were: 2″ dielectric diagonal (*top left*), 2X 2″ barlow lens (*top right and bottom left*) and 30mm 2″ Ultrawide eyepiece (*bottom right*)

In use with a variety of telescopes, the Moonfish Barlow provided bright clear lunar and planetary images with only a little annoying colour hugging the field edge. Star images were crisp at low powers, no annoying internal reflections although contrast suffered slightly with the faintest of DSOs, (*better baffling may help to sort this out*). Separating double stars at high powers was not a problem. With most eyepieces the edge sharpness was good except in the case of an eyepiece with obvious field curvature, and even here, there was a little improvement. Centre-field images are crisp and free from chromatic aberration. This Barlow gave its best performance when used with reflecting instruments. Its performance with the 210mm Dall-Kirkham and a 308mm f/6 Newtonian was nothing short of remarkable for its budget price. (*Be aware of its inward focussing position when used with a low profile focuser on a Newtonian*).

We need to place it in context with other image amplifiers out there. This is not a TeleVue Powermate, hence its performance with short f/ refractors may fall a little short of perfection, but then again it is not £250/€360 either. For £69/€105 it is difficult to fault the image quality at all. Thoroughly recommended.

Wish List

- Blackening the inside of the main barrel instead of leaving it light grey would be a good move.

The eyepiece.

The eyepiece tested is the 30mm 2″ Moonfish Ultrawide. This is the latest in the evolution of the original eyepiece offered some years ago by John Hopper in the US. Then it was called the ST80 Radian (*not to be confused with the TeleVue Radian*), and was problematic in that a great deal of cherry picking was required to find blemish-free eyepieces fit for sale. Since then, John Hopper at Astrobuffet has been joined by Moonfish in offering these eyepieces, and improvements have been claimed, not just to cosmetic

The 2" Ultrawide eyepiece and 2" dielectric diagonal on the Moonfish ED80.

finish but to performance. The early ST80 version of this eyepiece was not so good, with a poor performance on anything less than f/10. However, it was low price so it was considered a value for money wide-angle eyepiece rather than a competent performer.
Now this eyepiece under the Moonfish logo is even lower priced! £69/€99 seems ridiculous for an eyepiece of this type. Don't improvements cost money?
On first sight the eyepiece looks similar to the old Chinese ST80, although there is a more polished feel to it. The 2" barrel has a different finish to it now and the inset lip under the rubber eyecup now features an M49 camera thread, (*although the one tested did not have that feature – must have been the last of the previous batch. Unfortunately this meant that we did not get the opportunity to try a little eyepiece projection photography*).
Moonfish list this eyepiece as a five element eyepiece, the elements in three groups and fully multi-coated. Lens edges are also blackened to reduce internal reflections, and the 2" barrel threaded to accept 2" filters.
The dimensions of the eyepiece are quoted as: Length – 114mm, Weight 570g (1.2lb). Width is not mentioned but measured at 58mm (upper body). Eye relief is listed as 22mm. In practise the full field is visible without spectacles and even with thin spectacles. Wearers of thick glasses may not experience the full apparent field.
Measurement of the focal length of the eyepiece using a measurement technique of a simple lens (f = a/m+1), where a = the distance from an object (in this case a disc) to the lens, m = measured diameter of disc / measured diameter of imaged disc. The tested eyepiece measured to 31.43mm focal length. If this is typical of this eyepiece then we expect to see variations of +/- 1.5mm.
The apparent field is quoted as 80˚. In comparison to a Nagler (82˚) the apparent field of the Ultrawide, (the visible diameter of the field stop as seen through the eyepiece) although pleasingly wide, is notably smaller, in fact only a little wider than a Leica 22mm wide-angle (70˚) eyepiece. If the tested eyepiece is typical, this may place the apparent field in the mid-seventies rather than 80˚. If memory serves, this was also an issue with the earlier ST80 eyepieces.
In use, the issue of a few degrees of disagreement is a little academic as the field edge images are not sharp due to field curvature, (*a touch of re-focusing sharpens the edge image and defocuses the image at centre, and vice versa*). At field centre, the images are sharp and contrasty, with no astigmatism. This is certainly an improvement over the earlier form of this eyepiece. The size of the usable field of view due to field curvature places a restriction on the 'space walk' experience, an enjoyable aspect of using a Nagler, however, the use of the Ultrawide eyepiece for its intended use; wide-field scanning, low power views of large DSOs, is extremely rewarding. Stars are sharp at and near the field centre, and the view of M31 and the two orbiting galaxies with a 308mm f/6 Newtonian remains fixed in the memory, as does following the Veil trail.

Comparisons have previously been made with the much more expensive Naglers. In reality, the Ultrawide falls short of the optical performance of a similar focal length Nagler, in all departments, and does not match the engineering quality or attention to detail. However the Nagler is seven times more expensive and this must be taken into consideration. For £69/€99, the Moonfish 30mm Ultrawide is astounding value for money, an improvement over its earlier form, and now even cheaper! It is still true to say that owners of longer focal ratio instruments will enjoy it more, but as the experience of using it with an f/6 Newtonian showed, it is no longer a cheap SCT eyepiece. Thoroughly recommended.

Wish List

- Please matt black the inside of the 2” barrel
- Apparent field?
- Nothing else. At this price, can’t fault it further

Conclusion

How many times have we heard the expression “You get what you pay for”? Most of the time this warning is a faithful guide. With the accessories reviewed here, at such a low price there has to be a catch. Well, can’t really spot it. The eyepiece, Barlow and star diagonal tested all have small niggles and if these products were double the price, one could argue that these niggles were the catch. But they are not double the price………not yet anyway. If you desire good looking high performance optical accessories, but can’t afford the expensive choices around, then the performance of these Moonfish products for such a small outlay will amaze you. It is such a no-brainer that you shouldn’t even be bothering to finish reading this……………Oh, you’ve gone

□□□

Practical Astronomer wish to make it clear that the review and test results carried out on an instrument, mount or accessory are correct and valid for the reviewed sample(s) only. Other examples of the same product may or may not be found to be of the same quality. Product manufacturing techniques and quality control issues can result in variable standards for a single product.

The 2” Ultrawide eyepiece is BIG!