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A Review of the Reviews: TMB Super Monos Revisited

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In September, 2003, about two months after they were first released to the public, I published a review of the TMB Super Monocentric eyepieces here on Cloudy Nights. I tested the 10, 8, 6, 5 and 4mm Super Monos carefully against Zeiss and Pentax orthoscopics, arguably the best planetary eyepieces ever made up until that time. A TeleVue Radian also found its way into the comparison. My conclusion was that for viewing astronomical objects appropriate to their narrow apparent field of view, the TMBs equaled or exceeded the Zeiss and Pentax performance and were "worthy successors to the finest eyepieces of the past."

Then a year later in the August, 2004 issue of Sky & Telescope magazine, the TMB Super Monos were again reviewed. Gary Seronik, associate editor of Sky & Telescope and an experienced observer and reviewer, tested the 9, 8, 7 and 5mm TMB Super Monos against several excellent 8mm eyepieces: a Vernonscope Brandon, TeleVue plossl, Clave' plossl, and Edmund RKE. He worked hard to find significant differences between the TMB Super Monos and his reference eyepieces, but "never found a difference pronounced enough" to say that the TMBs were superior planetary eyepieces in comparison to the other eyepieces "without qualification." He also found significant flaws in the edge of field performance that I had not seen in the eyepieces I reviewed. After listing his reservations, however, his conclusion was similar to mine: "…these are first-rate eyepieces that will deliver views of the planets that are as good as your telescope will allow—no ifs, ands or buts about it."

However, the last line of his review did not mitigate his previous criticisms. The S&T review was widely viewed as negative by TMB Super Mono owners and defenders offering their opinions on the TMB Optical Yahoo user group. Gary at one point in his review of the eyepieces noted that he risked "damning them with faint praise," and TMB advocates appeared to believe that that was what he had done.

So, was I wrong? Was Gary wrong? What happened?

Similarities and Differences

Interestingly, my review and Gary's agreed on many areas. We agreed that the eyepieces were well made. We agreed that the colored band resulted in the focal length being difficult to read in the dark or under red light for some of the eyepieces. We agreed that the eye relief was comfortable, even at the shorter focal lengths, because of the narrow apparent field of view and the lack of an elevated rubber eyeguard. We also agreed that because of their narrow apparent field of view, these are not the best eyepieces to use at high powers in telescopes that do not have the ability to track the objects being viewed.

We also each reported some observations that the other did not. For instance, Gary noticed that the edges of the lenses were not blackened, a common practice with higher quality eyepieces. He also saw that the paint inside the barrels was extra-black to

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minimize reflection. On my part, I had more to say about how well they excluded light from the side compared with the Zeiss and Pentax orthos, the light throughput when testing indoors under controlled conditions, and the improved darkness of the background sky under excellent viewing conditions. Monocentrics have traditionally had problems with ghost images and vignetting, so I examined those issues as well and found they were not a problem with the Super Monos. I also noted two quality control issues in the first manufacturing run resulting in irregularities in the field stop and, in a very few eyepieces, chromatic aberration near the edge of field. (Incidentally, as I understand it, TMB's policy then and now is to replace any eyepiece with a manufacturing flaw at any time the flaw is identified.)

We also observed different objects in our tests. Gary examined the moon, Mars, Jupiter, and the stars Capella (with its faint companion) and Arcturus. He also examined a printed resolution test chart during daylight. In addition to testing their performance on planets (in my case, Mars), I was also interested in whether the Super Monos were useful in observing other types of astronomical objects. So I examined the moon, M13, the Double Cluster, the Dumbbell nebula, the Ring nebula, Polaris (with *its* faint companion) and the double-double in Lyra. I also viewed an artificial star to test sharpness, coma and astigmatism.

Gary and I had different findings in several areas. Most importantly and significantly, he found that in an 8" f4.5 Newtonian with a TeleVue Paracorr coma corrector, "as Mars drifted halfway to the edge of the field, the planet's disk became soft and blurry." Keep in mind that according to TeleVue, a Paracorr should reduce the coma in an f4.5 reflecting telescope to about that of an f8 telescope—this was a serious flaw he was reporting in the TMB eyepiece. Star images near the edge of field had significant astigmatism, and the problem was worse than with his Plossl and orthoscopic eyepieces "at the same field angle." As one might expect, he found the problem to be less severe in other telescopes at slower focal ratios (f6 and f9), but his conclusion was still that "the TMBs are not built for edge-of-field performance" and that this problem would "limit the effectiveness of these eyepieces for viewing the Moon," which is most satisfying when a sharp image is obtained across the entire field of view.

On my part, I didn't find the outer part of the field to have a problem. When testing the TMB Super Monos with an artificial star under controlled conditions at f8.9 (an f-ratio not too different than Gary's, given the effect of the Paracorr), their edge of field performance was actually better than that of the Zeiss and Pentax orthoscopics. Although the f-ratios weren't identical, the key factor here was the relative difference compared to the orthos. I did not specifically test the eyepieces "at the same field angle" as he did, but extrapolating from my results indicates performance at least as good with the monos as the orthos at an apparent field of approximately 25 degrees (that is, about two to three degrees away from the mono's field stop and about 10 degrees from the Zeiss and Pentax field stops). Outside at f8.9, I had similar excellent results when looking at star fields and lunar detail. In a 10" f5.6 reflector, I found that the outer quarter of the field was not quite as sharp with the 10mm Super Mono as with the monos producing higher powers,

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but it was still quite acceptable. The higher power monos had even better edge of field performance.

There were other differences in our findings as well. Gary found that differences in scatter on bright objects between the TMBs and his reference eyepieces were minimal, while I found slightly more distinct (but not huge) differences. His conclusion was that the difference between dirty and clean optics was likely to be "much more significant than the differences between eyepieces with two (the monocentric) versus four (the others) air-to-glass surfaces." He also found minimal differences between the Super Monos and his reference eyepieces in their ability to resolve high contrast detail in images of the moon and low contrast detail on Jupiter, but I found more obvious differences in resolution of detail and contrast in favor of the Super Monos.

So what do we make of this? Both of us are careful observers, and I have no reason to believe that his observations of edge of field sharpness, scatter, and resolution of high and low contrast detail were any less accurate than mine. If that is the case, then there must have been other reasons for our differing results.

And there were.

A Nightmare Error

When Gary asked Thomas M. Back for a loan of samples of the TMB Super Monos to review, Thomas wanted to maximize the validity of the review by not providing Gary with specially selected eyepieces that performed better than the average TMB monocentric. So he sent him eyepieces randomly chosen from the supply he had on hand. Unfortunately, Thomas did not do his usual quality control on those eyepieces. With some perverse version of Murphy's Law at work ("if anything can go wrong, it will"), the eyepieces he sent to S&T had significant astigmatism that affected the sharpness of the image at the edge of the field and the on-axis contrast, particularly in the longer focal length eyepieces. Thomas himself verified this when the eyepieces were returned to him, as he reported in mid-June on the TMB Optical Yahoo user group (message #16598 posted 6-17-04).

> "I tested all four on my double pass autocollimator, using my reference Strehl .997 TMB 100mm f/8 objective… The 9mm, and 8mm showed gross astigmatism, the 7mm less, and the 5mm none! And guess what eyepiece Gary didn't use, or used very little (in his testing), the 5mm. He tested defective eyepieces, and this is a fact. Not only are the three astigmatic, but because of that, they also do not perform on-axis as well as a TMB Mono that is free from all defects, because of glass and/or the optical centering of the three glass elements. Talk about bad luck!"

This was certainly bad luck for TMB, and it was also bad luck for Gary. No reviewer wants to review a flawed product. Clearly, this factor impacted Gary's conclusion that

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the eyepieces performed poorly off-axis and perhaps had less contrast on axis than he might otherwise have found.

So one major difference between Gary's findings and mine is most likely due to Gary unfortunately being given defective eyepieces to review. But there was another problem *both* of us had that affected our results.

The Telescope's Role in Testing an Eyepiece

Look for a moment at the main test telescopes we used to evaluate the eyepieces.

SERONIK			BELLG		
Telescope	Focal length	f-ratio	Telescope	Focal length	f-ratio
85mm Stellarvue SV85L apo refractor	748mm	8.8	90mm Takahashi Sky 90 apo refractor	800mm (with Extender-Q)	8.9
6" Newtonian reflector (homebuilt, 1/20 wave)	1372mm	9	10" Newtonian reflector (optics by Mike Spooner)	1380mm	5.6
8" Newtonian reflector (homebuilt, 1/20 wave)	915mm (1052mm with Paracorr)	4.5 (5.2 with Paracorr)	15" Newtonian reflector (Discovery Telescopes)	1900mm	5
3.5" Questar maksutov	1280mm	14.4			

There is good reason to believe that our choice in telescopes affected our findings. All the telescopes used for testing the eyepieces were of high quality. But the two small refractors, which both of us used extensively, did not have the aperture (and therefore the resolution) to do the best possible evaluation of eyepiece sharpness, which needs to be done at fairly high power. Double star observers are quite familiar with this issue. Not only does a telescope need sufficient aperture to resolve a close double, but sufficient power needs to be used to observe the split. Nor did these small refractors have the ability to do the best possible evaluation of contrast, which is more obvious when additional light is gathered at greater apertures.

So differences between *any* eyepieces would be hard to see in the refractors, particularly at low powers. And that is exactly what both of us reported.

Gary stated in his review that he did most of his evaluations with his Stellarvue SV85L. He also did most of his observations with the 8mm TMB Super Mono and four other 8mm eyepieces mentioned above, a Vernonscope Brandon, TeleVue Plossl, Clave' Plossl, and RKE. He used a TEC rotary eyepiece turret that allowed him to make rapid changes and comparisons between eyepieces, which was certainly a good thing. But at 8mm with his 748mm FL Stellarvue, he was making observations at only 94x.

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As I understand his review, at 94x he saw very little difference between the eyepieces regarding scatter from bright objects. Using the 8mm test and comparison eyepieces, he also had a single experience of a "subtly cleaner" view of low-contrast planetary surface detail on Jupiter, a "little better" view "at times" of a resolution test pattern during daylight, and a "subtle but definitely real" improvement in the view of a high contrast lunar mountain peak with the 8mm Super Mono. It is unfortunate that Gary did not make explicit in his review exactly what telescopes he used to obtain these results. His report of examining "delicate festoons and subtle shadings" in details on Jupiter implies views at higher powers with his other telescopes (his 6" and 8" reflectors would have given 172x and 132x, respectively, and his 3.5" Questar would have given 160x, all still less than ideal powers for planetary observing). But since he states that he made most of his observations with his small refractor (and there is a photo of him using the Stellarvue to examine the test pattern), I assume that most of his observations were constrained by the Stellarvue's limited aperture and power when using an 8mm eyepiece.

Even so, the optical flaws in his 8mm Super Mono may have degraded the on-axis contrast (as Thomas Back stated they might) sufficiently to at least partially wash out differences with the 8mm comparison eyepieces at any power with any telescope. As for the eyepieces at other focal lengths, and particularly the 5mm Super Mono that Thomas Back reported had no astigmatism, we do not know from Gary's review how much he tested them and what (if any) comparison eyepieces he used. It is not unreasonable to assume, however, that if he had tested other combinations of eyepieces and telescopes that produced substantially different results, he would have reported them.

My own problems with limited aperture and low power are also evident in hindsight. In my Cloudy Nights review, I reported that the 10mm Super Mono in the 800mm FL Sky 90 (at 80x) "tied with the 10mm Zeiss for sharpness and texture detail" when viewing lunar detail. But fortunately (I say fortunately because I did not realize at the time how essential it was to do this) I went further and looked at differences at higher powers, as I noted in my Cloudy Nights review.

> "However, the shorter the focal length, the more the advantage shifted to the monos. At 6mm (133x), the TMB barely edged out both the Zeiss and the Pentax in clarity of the view. At 5mm (160x), the TMB was clearly ahead of the Pentax. By 4mm (200x), the moon was crisper to my eye in the TMB than the Zeiss and gave more of a sense of actually looking at the moon's surface."

So at more appropriate powers, even the 90mm Sky 90 was capable of revealing differences between the eyepieces, and I would expect that the 85mm Stellarvue would have done so, too. But I certainly did not understand what my findings meant at the time I did the testing. My conclusion about the Super Monos was that "shorter focal lengths seem to give slightly more advantage than longer focal lengths," which I no longer believe is a correct conclusion. I think it is more likely that using a telescope with a focal length of around 2000mm, the 10mm Super Mono at 200x would likely perform as well

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as the 4mm Super Mono did at 200x with the Sky 90. At the very least, this is a question I would explicitly try to answer if I were testing them again.

In fact, though, I did answer it, at least in part. I had one more clue in my own observations that I missed in support of this idea. In telescopes with adequate power and aperture, I found a distinct difference between the 10mm eyepieces for compact nebulae.

> "With the 15" Discovery dob, the Ring (Nebula) with the 10mm Super Mono (at 190x) was significantly more distinct and interesting to view than with the 10mm Zeiss or 9mm Pentax. This observation was confirmed on the final night of viewing with the 10" Spooner (at 138x). There was a more distinct shape to the nebula, and it seemed to stand out more from the background."

It is worth commenting on the use of Newtonian reflectors for planetary observing. Some observers are passionate advocates of medium to large aperture (generally 130 to 180mm) apochromatic refractors for planetary viewing. The reasons include the scatter from a reflecting telescope's mirrors (reduces contrast), the Newtonian's central obstruction (also reduces contrast), as well as the image distortions due to tube currents, boundary layers at the mirror's surface, and cool-down distortions in the glass. However, the advantage of larger aperture reflectors in increasing contrast (even if only at 75% to 85% of the contrast in an unobstructed telescope of similar aperture) and resolution of detail (which is unaffected by the obstruction) can be very desirable for planetary work. Noted planetary observers Donald Parker, with his 16" f6 reflector, and Damian Peach, with his 11" Celestron SCT, have shown in their CCD and visual observations how much can be accomplished with high quality large aperture non-apos.

Except when I was using the Sky 90, my own planetary observations when testing the Super Monos were made at powers ranging from 230x to 317x with a 10" f5.6 reflector and a 15" f5 reflector. At those powers and apertures, I thought "the Super Mono gave a slightly better view at the best moments of seeing." At "moments when it was justified (by the quality of the seeing), the TMB gave a view of the planet's surface that seemed more realistic," and under those conditions, "the Zeiss again seemed maybe a hair less crisp than the TMB." I also thought that the 6mm Radian, although very sharp and comfortable to use, had noticeably less contrast than the monos or the orthos.

These are not observations supporting an overwhelming advantage for the TMB Super Monos. What they do support is my conclusion that during times of intermittent or sustained good seeing, these eyepieces are as good or better than the best eyepieces previously available for planetary observations, double star viewing, and observations of compact nebulae and globular clusters.

Conclusions About Our Conclusions

Neither Gary Seronik nor Sky & Telescope is in the business of trashing small companies producing unique, high quality astronomical products. Gary clearly worked as hard as he could to find something to distinguish the TMB eyepieces from the others in his review

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sample. He spent "countless hours" looking for differences. But I believe that although his observations were accurate, they were limited by the flaws in the eyepieces he tested. They were also limited by the aperture of the 85mm f8.8 refractor he used for most of his observations and the low powers he obtained in that telescope with the 8mm test eyepieces.

Also, since I was comparing the TMBs to what are usually acknowledged to be the best quality planetary eyepieces that had been previously produced, the implications of my conclusion were different. As I noted in the first paragraph of this review, I concluded that the TMBs equaled or exceeded the Zeiss and Pentax performance and were "worthy successors to the finest eyepieces of the past." What Gary could conclude based on his results was that the TMBs were "at least as good as the eyepieces I used in my comparison" – which is not an insignificant conclusion, but it is inevitably limited by the marginally lesser quality and reputation of his comparison eyepieces.

People's behavior is affected by reviews. After my own review of the TMB Super Monos, I sold my previously much-loved set of Pentax orthos as being third best (but still superb) among the planetary eyepieces I owned. After Gary's review, the usual "bump" in sales of an item favorably reviewed in Sky & Telescope didn't occur; indeed, sales of TMB Super Monos dropped.

It is true that there might have been other reasons for the drop in sales, including the fact that the planets were not easily viewed over the summer of 2004. Nonetheless, anyone interested in high quality astronomy equipment is also interested in it remaining financially viable in the marketplace based on its actual quality and performance, particularly when the highest quality alternatives haven't been in production for years. I believe that we reviewers have an obligation to get it right, as best we can – and where necessary, make it right.

It is my understanding that the editors of Sky & Telescope have considered the possibility of re-reviewing the Super Monos. Given the flaws in his test eyepieces, it seems to me highly desirable and appropriate that Gary or another reviewer have another opportunity to evaluate them for S&T. I also invite others to contribute their thoughts in the Cloudy Nights forum accompanying this review.

In closing, I repeat my summary chart from my September, 2003 review. The flaws in my own reviewing technique tend to underestimate the TMB Super Monos' performance, so I stand by these conclusions. Five stars is my highest rating with regard to how appropriate I believe the TMB Super Monos are for viewing different astronomical objects.

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Object	***TMB Super Mono***	***Comments***
Planets and moon	*****	Better contrast, more realistic view of surface detail
Double stars	*****	Cleaner separation, less scatter
Planetary or detailed nebulae and galaxies	*****	Better view of structure and detail
Diffuse nebulae and galaxies	**	Little advantage, perhaps may stand out better
Compact and globular clusters	****	Sharp, clean view but may seem constricted by AFOV
Open clusters or star fields	*	Better in eyepieces with wider field of view

As for their optical performance, and in particular, their optical performance off-axis, I give the 10, 8 and 6mm eyepieces I tested four stars, by which I mean: "Not quite perfect off-axis at appropriate f-ratios for planetary viewing, but pretty close." The 5 and 4mm, I'd rate five stars. Gary gave the flawed eyepieces he tested a Sky & Telescope rating of two stars for off-axis performance: "Defects noticeable during normal use – performance compromised."

As for their performance on axis, Gary and I agree. He gave the TMB Super Monos the S&T maximum five-star rating: "Sensibly perfect. No meaningful improvements possible."

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