THE TAL SUPER & ULTRA WIDE ANGLE EYEPIECES

(As Viewed through a 4" f/8 APO and 10" f/4.7 Dobsonian)

By: William Paolini (wapaolini@hotmail.com), 2013

Figure 1.
Front Row (left-to-right) - 60° AFOV TAL 20mm & 10mm Super Wide Angle (SWA)
Back Row (left-to-right) - 80° AFOV TAL 24mm, 25mm, 20mm, & 15mm Ultra Wide Angle (UWA)
Image by the Author; Eyepieces courtesy of www.talteleoptics.com

I. Introduction

TAL telescopes and eyepieces, made in Russia by Novosibirsk Instrument-Making Plant (www.npzoptics.com), is a long respected brand for optics in amateur astronomy. TAL astronomy products are available worldwide from multiple sources including:

United States: www.talteleoptics.com,
Russia: www.telescopes.ru,
United Kingdom: www.acecameras.co.uk, www.1stoptics.com, www.opticalvision.co.uk.

The TAL Super Wide Angle (SWA) and Ultra Wide Angle (UWA) eyepieces are the two TAL wide angle eyepiece lines that compliment their line of Super Plössls. The SWA is advertised to have a 60° apparent field of view (AFOV), and the UWA is advertised to have an 80° AFOV. For this review, the 10mm & 20mm SWAs, and the 15mm, 20mm, 24mm, & 25mm UWAs were examined and field tested.

According to the www.npzoptics.com website, the SWAs have a 5 element 3 group design in a 2-1-2 configuration, the UWAs have a 6 element 4 group design in a 2-2-1-1 configuration for the 15mm, 20mm, and 25mm focal lengths, and the 24mm UWA use an 8 element 5 group design in a 2-2-2-1-1 configuration.

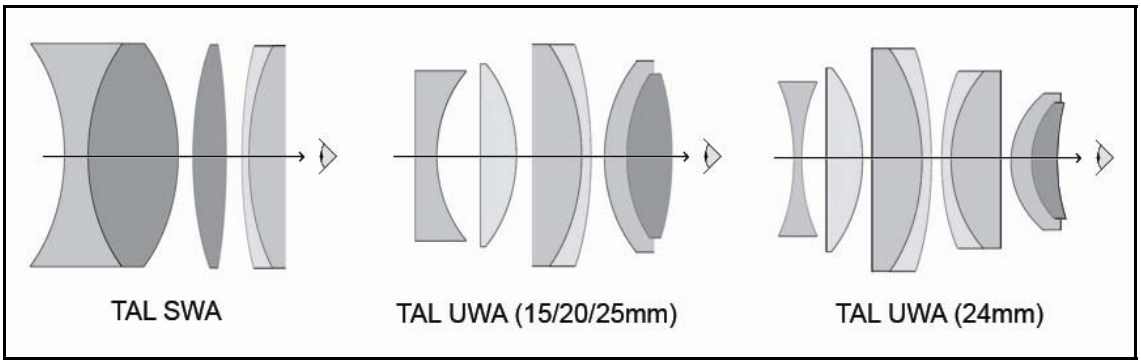

Figure 2. TAL SWA and UWAs Lens Configurations (for *illustrative purposes only*)
Illustration by the Author

The TAL SWAs and UWAs are advertised to have the following characteristics (see http://www.npzoptics.com/files/Okulars.pdf):

SWA --

Focal Length (mm)	AFOV	Eye Relief (mm)	Weight (oz)	Elements/Groups	Coatings	Barrel (inches)
10	60º	6.5	3.2	5 / 3	FMC	1.25
15	60º	9.8	4.3	5 / 3	FMC	1.25
20	60º	13.0	4.3	5 / 3	FMC	1.25

Table 1. Manufacturer supplied data for the TAL SWA eyepieces

UWA --

Focal Length (mm)	AFOV	Eye Relief (mm)	Weight (oz)	Elements/Groups	Coatings	Barrel (inches)
15	80º	7.3	4.6	6 / 4	FMC	1.25
20	80º	9.8	11.3	6 / 4	FMC	2.00
24	80º	11.6	15.8	8 / 5	FMC	2.00
25	80º	12.2	12.7	6 / 4	FMC	2.00

Table 2. Manufacturer supplied data for the TAL UWA eyepieces

II. Physical, Mechanical, and Optical Examination

The TAL SWAs and UWAs, like the TAL Super Plössls, are robustly built. The have traditional chromed brass barrels (with no undercut - again thank you), all metal housings, removable soft rubber eye guards (except the 24mm), and some have rubber grip panels on the housings. The eye guard, while flexible and can be pressed down, does not stay in the down position. The interior of the eyepiece uses metal retaining rings to secure the optics, and the field stop and filter threading are integral (i.e., milled) with the barrel. The interior is also blackened with a nicely non-reflective flat finish. While the interiors are well blackened, the field lens retaining rings are a shiny black instead of a matte finish. The exception is for the 24mm UWA where the attention to detail, fit, and finish is at a more refined level, reminiscent of the original Tele Vue smooth sided Naglers. Interestingly, when looking over some of the older reviews on the TAL 24mm from the early 2000's, most reported its fit and finish as only adequate. This 2013 version however, has a build-fit-finish that is fully in the same class as other smooth sided premium eyepiece like the older Tele Vue Naglers and Meade 4000 UWAs. Finally, the bottom of the barrels on the SWAs and UWAs are threaded for standard filters. Lens edges appear to be fully blackened.

Figure 3. Interior views (left-to-right) of the 24mm UWA, 25mm UWA, 20mm SWA, and 10mm SWA
Image by the Author; Eyepieces courtesy of www.talteleoptics.com

Lens coatings give a purple-blue/violet, or amber/yellow colors to light reflected off the eye lens surface. Graphics are engraved into the metal housings and paint filled. Overall, they give the impression of being sturdy, well built, have good heft, and have good fit-and-finish.

Figure 4.
Eye lens multicoating reflections
Front Row (left-to-right) - 60° AFOV TAL 20mm & 10mm Super Wide Angle (SWA)
Back Row (left-to-right) - 80° AFOV TAL 24mm, 25mm, 20mm, & 15mm Ultra Wide Angle (UWA)
Image by the Author; Eyepieces courtesy of www.talteleoptics.com

Measurement of the eye relief of the TAL SWAs and UWAs revealed advertised eye relief to be close to bench test measures (within +/- 10% for all but the 20mm UWA). While optical eye relief measures (i.e., the measure from the center of the top surface of the eye lens) were close to the advertised numbers, eyeglass wearers should take note that none of the eye relief numbers other than that for the 20mm SWA, advertised or measured are sufficient to see the entire AFOV with eyeglasses as most eyeglass wearers report needing at least 13mm of eye relief to see an entire AFOV. The exception is possibly the 20mm SWA which showed 12.3mm of usable eye relief when measured from the top housing with the eye guard removed. For observing without eyeglasses, none of the SWA/UWA focal lengths tested felt excessively tight except for the 10mm SWA, which had a measured usable eye relief of 4.7mm without the eye guard.

Apparent field of view (AFOV) characteristics were also very close to advertised numbers for the SWAs and the UWAs, being within 7% of direct measures. The AFOV measures for the SWAs varied by only 2 degrees for the 10mm and was right on for the 20mm. For the 15mm, 20mm, and 25mm UWAs, the measured AFOV was 75º instead of the advertised 80º. Visual comparison of these UWAs to both the 70º AFOV of the Pentax XWs and the 82º AFOV of the Meade 5000 UWAs validated that the AFOV of the TAL UWAs fell between these two. The 24mm TAL UWA however, which uses a different optical prescription from the other TAL UWAs, showed a noticeably larger AFOV, measuring at a full 85º, or 10º more than the other UWA focal lengths. Again, a quick visual check of the 24mm TAL with the 82º Meade 5000 UWA confirmed that the AFOV for the TAL was slightly larger, providing confidence in the 85º bench test measure.

Finally, the common aberrations that one usually finds in all eyepiece designs where the AFOV is larger than approximately 57º (one radian) is some combination of rectilinear distortion (RD) and angular magnification distortion (AMD). Surprisingly, almost all focal lengths of the TAL SWAs and UWAs showed a very orthoscopic FOV with none or extremely little of either RD or AMD. In the 24mm UWA either distortion was virtually impossible to see in the bench test. In the other SWA and UWA focal lengths, RD and AMD were similarly non-existent or extremely slight, with the 10mm SWA having the most of the group (but still less than is common). Field curvature was the only aberration apparent in bench testing.

SWA --

FOCAL LENGTH (mm)	ADVERTISED		MEASURED / OBSERVED				
	AFOV	Eye Relief (mm)	AFOV	Eye Relief (mm) from Eye Lens	Eye Relief (mm) from Top Housing	Eye Relief (mm) from Eye Guard	Field Stop
10	60º	6.5	58º	6.0	4.7	-0.4	Not Sharp
20	60º	13.0	60º	13.6	12.3	4.7	Not Sharp

Table 3. Manufacturer supplied data vs. measured data for the TAL SWAs

UWA --

FOCAL LENGTH (mm)	ADVERTISED		MEASURED / OBSERVED				
	AFOV	Eye Relief (mm)	AFOV	Eye Relief (mm) from Eye Lens	Eye Relief (mm) from Top Housing	Eye Relief (mm) from Eye Guard	Field Stop
15	80º	7.3	75º	7.9	7.2	0.9	Not Sharp
20	80º	9.8	75º	11.1	6.0	-2.0	Sharp
24	80º	11.6	85º	10.9	8.4	n/a	Sharp
25	80º	12.2	75º	13.6	6.0	-1.6	Sharp

Table 4. Manufacturer supplied data vs. measured data for the TAL UWAs

III. Field Observations

The TAL SWAs and UWAs were tested in a fast focal ratio telescope (Orion 10" f/4.7 Dob) and a more conventional medium focal ratio telescope (Takahashi 4" f/8 APO) to gauge their performance at different focal ratios. For tests in the fast Orion XT10 Dob, a Tele Vue Paracorr was used to mitigate the effects of the mirror's coma.

With the fast focal ratio Orion Dob and the longer focal ratio Takahashi APO, a variety of star fields as well as the Ring Nebula (M57), the Great Hercules Cluster (M13), the Perseus Double Cluster, and some showcase colorful doubles like Albiero were observed. Both the 20mm and 10mm SWA eyepieces showed well-corrected, tight star points in the Orion XT10 with Paracorr over approximately 85-90% of their FOVs, even with stars as bright as Vega. The predominant aberration in the last 10-15% of the FOV was field curvature for the 20mm and was astigmatism for the 10mm -- star points could therefore be refocused to satisfyingly sharp points in the 20mm SWA, but not in the 10mm SWA. The very edge of the field of view (FOV) for both focal lengths however, vignettes near the field stop resulting in brightness fall-off and dimming of the view (slightly worse in the 20mm than in the 10mm). Because of this dimming, the field stop did not appear sharply defined in either eyepiece. The SWAs are not parfocal so a refocus is needed when moving from one focal length to the other.

Moving to the slower f/8 APO, more of the FOV was well corrected with 90-95% of the FOVs for both the 20mm and 10mm SWAs showing sharp star points. The predominant aberration in the last 5-10% of the FOV was field curvature (FC) which can be refocused for sharp star points, and an inconsequential amount of astigmatism. In the XT10 with Paracorr the 20mm SWA performed slightly better than the 10mm. In the longer focal ratio TSA-102 it was just the opposite as most of the astigmatism was not apparent at f/8 and the field curvature was so minimal in the 10mm SWA that it could easily be accommodated by focusing mid-way between the focus extremes of the slight field curvature. Both focal lengths also showed some lateral color right at the field stop. Switching between the 10mm and 20mm SWAs, the slightly smaller AFOV of the 10mm SWA was readily apparent. Eye relief with the 20mm SWA was close, but felt comfortable, whereas eye relief for the 10mm SWA felt uncomfortable. Image brightness and visual contrast was outstanding on all targets for both eyepieces, and color saturation was excellent with the blue and yellow-gold stars of the double star Albiero showing very vivid and rich. Light control in both eyepieces was excellent with no flare or ghosting.

Moving to the UWAs, for the 25mm, 20mm, and 15mm, they all showed a well-corrected field in the Orion XT10 with Paracorr over the central 80-90% of their AFOV. The 25mm showed the best performance with field curvature being the predominant off-axis aberration and a small amount of astigmatism and lateral color. However, the astigmatism was small enough that even very bright stars could be refocused to a satisfyingly tight star point right to the field stop. The background FOV in the UWAs was uniformly dark and the field stop was sharply defined for all but the 15mm, all presenting star fields with nicely high visual contrast. When observing the Moon, a very small amount of flare could be induced when the Moon was just inside the field stop. However, this flare was very dim and was not distracting. Eye relief was tighter in the 20mm, requiring the eye guard to be pressed down to see the entire AFOV effectively. The off-axis of the 20mm showed field curvature and astigmatism in the last 15% of the FOV. The astigmatism was minor however, and star points could be refocused to satisfyingly sharp points right up to the field stop. Finally, the 15mm UWA performed about the same as the 20mm, except the off-axis astigmatism was greater and star points could not be refocused sharp in the last 20% of the FOV. Also, the 15mm UWA's

FOV vignettes close to the field stop resulting in a brightness fall-off in the off-axis and showing the field stop as indistinct. The UWAs are not parfocal so a refocus was needed when moving from one focal length to another.

Using the slower f/8 focal ratio of the Takahashi APO without the field flattening of the XT10's Paracorr, field curvature impacted the outer 25% of the FOV for 15mm, 20mm, and 25mm UWAs. At optimum focus, only the central 75% of their FOVs showed as well-corrected. However, stars could be easily refocused to sharp points right up to the field stop in both the 15mm and 20mm. The 15mm FOV again showed brightness fall-off in the far off-axis making the field stop appear as not sharply defined. For the 25mm UWA, the central 90% of the FOV was well-corrected with sharp star points. In the last 10% of the FOV, the star points could not focus to sharp due to astigmatism. The 25mm showed the most richly uniform dark background FOV with a sharply defined field stop, providing that classic high contrast diamonds on velvet look for star fields. Color saturation was good in all the UWAs, but was not quite as vivid as it was in the SWAs, using the colorful double of Albiero as the baseline test.

Since the 24mm UWA is a different optical design than the other UWAs, its performance was assessed separately. While eye relief was tight for this eyepiece it was still comfortable. The exit pupil behavior was also exceedingly comfortable, providing a level of comfort that was some of the best I have experienced. At no time were blackouts or kidney bean effects ever observed and the eyepiece was very forgiving of eye placement. The field stop showed sharp and the FOV showed uniform background sky darkness for excellent visual contrast. Scatter was also noticeably less in the 24mm UWA than in the other UWA focal lengths tested. At no time was flare or ghosting observed, even when the Moon transitioned into the FOV. Slightly less well corrected than the other TAL UWAs, approximately 60-70% of the FOV was well-corrected in either the 10" f/4.7 Dob with Paracorr or the 4" f/8 APO, with the off-axis showing field curvature, lateral color, and astigmatism. Performance in the XT10 with Paracorr was actually a little better for the 24mm UWA than in the TSA-102, probably due to the Tele Vue Paracorr flattening the field and thereby reducing some of the field curvature. Observing with the TAL 24mm UWA was very engaging with its expansive 85 degree AFOV and very comfortable exit pupil making eye positioning easy and intuitive.

IV. Conclusion

Overall, the TAL UWAs were my favorites of the two product lines. Considering how compact the 2" versions of the UWAs are, they were a joy to use in the field. The 25mm UWA was my particular favorite, showing large patches of sky with its longer focal length and expansive 75° AFOV. While I am not a big fan of using 2" eyepieces, the TAL 25mm UWA was an exception for me as its relatively compact size, easy handling characteristics, and expansive FOV made it a nice companion for observing large showcase celestial objects like the Great Orion Nebula and the Perseus Double Cluster.

Figure 5. 25mm TAL UWA
Image by the Author; Eyepieces courtesy of www.talteleoptics.com

End Notes:

The methodology used for this review was to have a single experienced observer evaluate each available focal length of the eyepieces during each observing session. Each observing session used either one or two telescopes, and generally evaluated no more than two or three performance criteria on one or two celestial targets. This approach, while increasing the number of observing sessions necessary, reduces possibilities of both confusion and fatigue as each observing session allows concentration and focus on only a limited number of criteria.

Figure 6. Orion 10" f/4.7 XT10 & Takahashi 4" f/8 TSA-102
Image by the Author

All observations were performed through both a 4-inch Takahashi TSA-102 f/8 APO and a 10-inch Orion XT10 f/4.7 Dobsonian. Each instrument was thoroughly checked for proper collimation prior to each observing session, and was given the required time to reach thermal equilibrium to ensure peak optical performance. These two instruments were chosen to gauge performance of the eyepieces in both medium and fast focal ratio telescopes. A Tele Vue Paracorr coma corrector was used throughout all observations with the Orion XT10.

The observations were conducted in both evenings and early mornings during September and October 2013 from a light-to-moderately light polluted suburban Virginia location west of Washington D.C. At this location the typical limiting magnitude varies between 3.5 and 5.0. Unless otherwise noted, seeing conditions were never below Pickering 5 for stellar and/or deep space object performance rankings, and were never below Pickering 6 for lunar and/or planetary observations.

Disclaimer - No matter the outcome of this or any other review, your individual results with the equipment being reviewed should be expected to vary. Given the variation between the same equipment types due to manufacturing tolerances, and the differences in seeing conditions, telescopes, observer physiology, and observer psychology (i.e., likes, dislikes, expectations), your unique "optical chain" may alter your results when compared to this review. Therefore, like any review or eyepiece/telescope comparison you read, remember that it should only be viewed as a guideline to indicate generally how the equipment being reviewed may perform for you when used in similar telescopes. When used in your unique equipment, always remember the adage "Your Mileage May Vary" (YMMV).

~ ~ ~