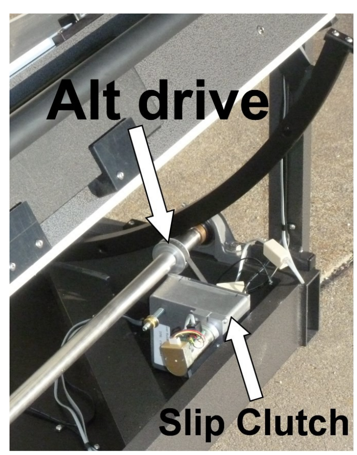
A 32" f2.8 SlipStream Telescope with Lockwood Optics

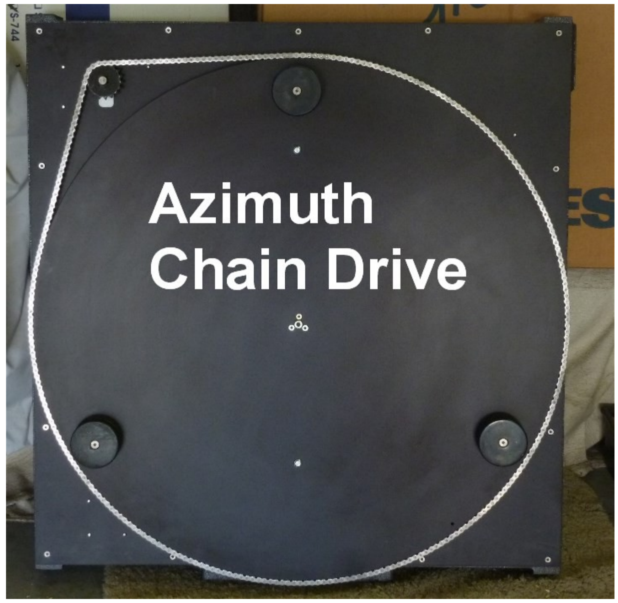
Recently, Equatorial Platforms has completed the construction, assembly and testing of a new 32" F2.8 SlipStream Telescope. This article is a report of the telescope's mechanical and optical performance, based on testing/calibration over a period of several evenings. While the quality of the night sky during these sessions was not superior, still certain evaluations can be made.

1) DESCRIPTION OF THE TELESCOPE

The overall structure of the telescope is a scaled up version of our standard SlipStream alt/az design. It features a stiff welded-aluminum frame, powdercoated with a deep gray hammertone finish. Large altitude bearings rest on two 1" diameter stainless steel rods that rotate in pillow block ball bearings. Both the altitude and azimuth movements of the telescope are driven by servo motors running through slip clutches. The altitude drive consists of a belt and pulley arrangement turning one of the stainless steel rods. As the rod is turned, both of the altitude wheels are driven, making for a very stable movement.



For the azimuth drive a sprocket attached to the output shaft of the slipclutch turns a stainless steel chain that is wrapped around the edge of a large machined aluminum groundboard disc. Both drives work remarkably well and provide precise, quiet (actually, noiseless) tracking. The slip clutches allow the user to move the telescope by hand at any time without having to undo any levers to disengage the drives. Or the telescope can be moved with the cordless hand control, which offers the user a three speed slew in both axes. Two sets of encoders assure that pointing accuracy is maintained at all times, whether the scope is moved by hand or with the push buttons.



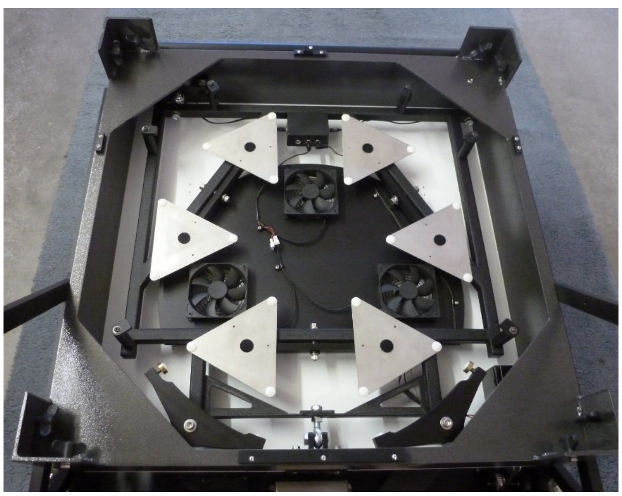
The remarkable Sidereal Technology (http://www.siderealtechnology.com/) drive controller is used to power the motors. The SiTech drive system features a small stand-alone computer that is attached to the telescope rocker box. This computer analyzes information from both sets of encoders many times a second and is constantly updating the movement of the servo motors. The telescope will track objects with no other device needed. But if you add an Argo Navis or Sky Commander DSC, then full motorized GoTo operation is now possible. The 32" telescope performed marvelously in this regard, with the GoTo's putting objects in a 275x eyepiece across the sky. Tracking, even at 900x, was vibration free. And with the cordless hand control, objects could be quickly centered in the field of view by the push of a button. There is no lag when using the push buttons, and almost no backlash. With the faster slew, one could glide up and down the terminator of the moon as if doing a flyby. And when using the highest powers the slow slew allowed one to move an object around the field with no effort or need to touch the telescope. Of course, at any time it was always possible to just grab the scope by hand and either center an object or explore the area around it. Seamless performance.

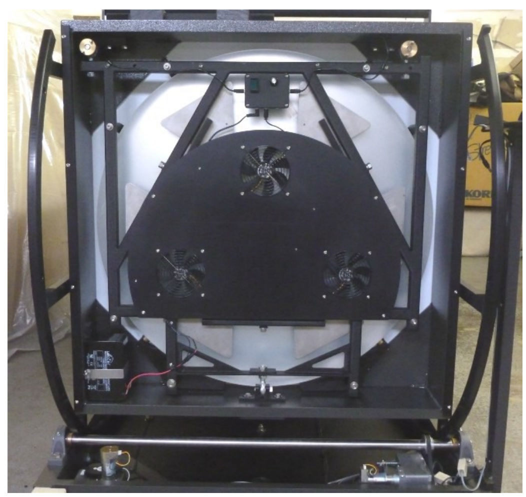
Setup and use of the telescope was done with little effort. Large tires provide easy movement of the 400 lb structure, even over grass or dirt. No heavy wheelbarrow handles to lift! And the low eyepiece height offered by the hyper-short f/ratio (88" at the zenith) allows the use of a small, easy-to-handle ladder. This is a big telescope that does not intimidate.

2) INSTALLING THE OPTICS

What can one expect, performance-wise, with an f2.8 Newtonian system? This was the question rattling around in the back of my mind during the year spent constructing the telescope and waiting for the optics. I had read some of the reports from Mike Lockwood and others about the performance of his ultra-short mirrors, but had never used one myself, so I retained a bit of skepticism.

One day, the primary mirror arrived, encased in an incredibly sturdy wooden crate (thanks Mike!). The mirror cell which was waiting for the 32" primary is a welded and powdercoated steel structure made from 1" square tubing. The back support for the mirror is a low profile 18 point flotation setup with stainless steel triangles. Two rocker arms carry the 4-point edge support. The whole cell, with mirror,





swivels at its base when moved with the two large brass collimation knobs. These knobs are near the top of the mirror box and easily accessible even with the scope pointed at the zenith. The three cooling fans in the back of the cell come with an adjustable speed control.

For the large 8" secondary, the owner of this telescope chose a lightweight cellular mirror which was provided by Mike Lockwood. When it arrived, this mirror proved indeed to be quite light in weight compared to a similar sized monolithic piece of glass. It was

mounted onto a custom holder made by Randy Cunningham at AstroSystems. Because of the shape of the diagonal, it had to be glued onto the holder's face plate, something I have always been leery of doing. It seemed especially dicey for a mirror of this size.

Still, it was the only option. The back of the mirror is not a solid piece of glass, but there were three obvious places to put spots of silicon glue. In the end, it turned out quite well and the mirror does not show any sign of being distorted by causing warped or astigmatic images. There are three clips on the holder that will restrain the glass only if there is a failure of the glue. The plate that the diagonal is attached to is adjusted in tilt by three spring-loaded screws mounted to a second smaller plate. This works very well and it is easy to precisely adjust the mirror for collimation. The 4-vane spider that Randy also provided is super heavy duty. Once the vanes are tightened with two 1/4" bolts apiece, the rigidity of the whole assembly leaves nothing to be desired.

3) COLLIMATION and FIRST LIGHT

So, the mirrors were installed and then on the next clear night the telescope was rolled out from my shop to the observing site. The scope was then raised off its wheels and leveled to the ground by shimming up the three feet on the bottom of the groundboard as needed.

Next came collimation of the optics. This proved to be a snap with my Glatter laser. When it got dark, I tuned up the collimation a tad using an out of focus star. The movement of both the primary collimation knobs and the secondary screws is on the stiff side, so once an adjustment is made, it stays there. There is no slack or looseness.

Once the optics were collimated and the tracking engaged, we were ready for First Light! The moment of truth had come – how would this large fast mirror perform? My observing partner for this occasion was noted astro-imager (and avid visual observer), Tony Hallas.

Our first object was Vega, since it was the brightest star in the twilight sky. The seeing was pretty good, as it often is early in the evening, before our foothill air gets turbulent when darkness settles. A 7mm Pentax XW eyepiece was put into the Type II Paracorr giving about 375x. Vega focused down to a blinding point of light. There was no question when you were in focus. It just snapped in. Both inside and outside of focus, sharp and contrasty diffraction rings were visible.

They were almost identical. This surprised me! With fast mirrors I was used to seeing diffraction rings on one side of focus (usually outside of focus), but just mush and spikiness on the other side. But not with this mirror. One thing working in our favor was that the mirror was pretty much cooled down at the time since the scope had been in my shop all day, instead of out in the hot sun.

As darkness settled, we moved from one thing to another quickly in order to get some views in of various objects before the seeing inevitably worsened as the evening progressed. First object was M13, fairly low in the west. Nice view at 370x, considering its low altitude and the crescent moon nearby. Thousands of stars filled the field. They were tiny, discreet pinpoints of light, a testament to the sharp focus this mirror was producing.

Next we went to the Ring Nebula, which was higher up and well placed for a good view. And a good view it was! First at 380x. Then at 880x. At that high power it dominated the field of view. While the seeing was now starting to go downhill, the central star was still visible, sometimes with direct vision when the seeing sharpened up. This was with a so-so suburban sky (Milky Way visible, but not spectacular) and a crescent moon. Also to be noted, the tracking at that high power was excellent, with no vibration or shaking. Using the hand control at the lowest slew rate I could glide that huge image of the Ring to the center of the field with no difficulty. Then I did Go-To's to various other objects like the Dumbbell, the CatsEye, the Double Cluster and NGC 891. The scope quickly found every object in a 260x field of view.

We used a Paracorr II throughout the session, mostly with my higher power Pentax XW's (10mm and 7mm) and Tony's Delos eyepieces. The highest power of 880x was achieved with a 3mm Radian. But I also wanted to test the sharpness, especially the edge sharpness, with a lower power. So I put in a 20mm Nagler Type5, which, with the Paracorr, produced 132x with a 2/3 degree field of view. Stars were pinpoints right out to the edge of the field! Yes! So much for worries about the coma of an f2.8 focal ratio. The fabulous Type II Paracorr just ate it up.

4) CONCLUSION

Suffice to say for now that we were frankly stunned by the telescope's performance, both mechanically and optically. We did not expect to see the kind of images this f2.8 mirror delivered. Tony, especially, is wary of shorter mirrors. For the 24" SlipStream Telescope that I built for him, he did not even want to go sub-F4, much less sub-F3! But after those first views with the 32", he emailed Mike Lockwood with these comments:

" Last night I had the opportunity to try out the 32" f/2.8 Slipstream for which you made the optics ... amazing!

The seeing was less than ideal but you could see the figure on the mirror was outstanding, and with a Paracorr II the stars were round to the edge of the eyepiece.

When you see the scope for the first time, it's kind of a shock ...
like, 'what the heck is THAT ...???'

The real shock is when you look through it and see those perfect stars. This isn't supposed to happen …
Congratulations to you and Tom for pulling off the impossible."

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