Jack Eastman
Speaks on His Telescopes
Part 1

In response to Pat Ryan's quest for material for the D files, I am writing the descriptions of several of my attempts at telescope making in a few installments. First, a bit of history. This whole business of astronomy (and subsequent telescope making) got started here in Denver when I was in the 2nd grade. My dad took me out in the yard and we observed the moon with his 8X30 binoculars. A year or so later we moved to Los Angeles, and by a fluke the hook of astronomy became more firmly set. We were at Knotts Berry Farm enjoying dinner, gold panning and their various mineral exhibits and as we were leaving we saw a sign, "observatory". We went over to this little building full of astronomical photos, books etc. and for a dime we could go out back and see Jupiter with a gasoline powered telescope. (The building was far enough from the rest of the place that they had a gas generator to run the telescope drive) The view was stunning and I was terminally hooked. The KBF telescope was a 9-inch Newtonian. My parents bought me a book (Bernhart, Bennett & Rice, New Handbook of the Heavens) and that was it. I was caught.

Then came the Griffith Observatory, Planetarium shows and peeks through their 12-in. Zeiss refractor. I HAD to have a telescope!! The 8X30s simply didn't cut it. My first ever real telescope was a 40mm Polarex, identical to the Unitron 40mm Alt-Az. Wow! the moons of Jupiter, Rings of Saturn and all. I needed a bigger telescope! Got to have a bigger telescope!! Next came a 60mm Alt-Az., Also a Polarex, and this was a new one with lots of eyepieces and other goodies. I still have this one, you'll hear about it in another article. A year goes by, I had discovered Unitron, and they have even bigger 'scopes! I needed a bigger telescope! Got to have a bigger telescope!! This time my folks took me up to the Griffith Observatory where I joined the L. A. Astronomical Society, signed up for the mirror grinding school, bought a 6-inch kit and had at it. There'll be more about the 6" in a later writing. A couple of years go by, and I needed a bigger telescope! Got to have a bigger telescope!! My parents really got tired of this, and under the Christmas tree in 1956 was a real big and heavy box. I had wanted (besides a bigger 'scope) a 7mm eyepiece. That's what I thought was in the box. The last eyepiece I got for my birthday or whatever was in a huge box with a zillion other little things, pieces of wood, stones etc. I thought "here we go again". My folks did have a sense of humor. No, in this box was a 12.5-inch grinding kit, the biggest obtainable. I think my parents were so sick of me squealing "I needed a bigger telescope! Got to have a bigger telescope!!" that they thought this would shut me up and keep me busy for a while. They hoped for quite a while!

What follows is a description of this instrument, which I still have and is still in service. I call it the old workhorse, and is the one I do most of my serious observing with.

The design desirement for this 'scope was to be an f/6, in the belief that the optics were still "makeable" and it wouldn't be impossibly large mechanically. As I roughed out the mirror, the focal length got shorter, seemingly, at the rate of feet per minute until it got to about f/10 By the time it was at f/9 it was getting shorter, it seemed, by feet per month. Several pounds more of #80 grit and it was down close to f/8, getting shorter now by inches per decade. This is why it is f/7.6. Yes! 'tis a monster. Over all it took about 100 hours from start to finish on the mirror over the course of about 6 months. I had all but given up on the mirror, after my best effort at figuring, and took it to Cave optical Co. for possible refiguring. Tom Cave redid my first 6" and did a magnificent job on it. When I went to hear the verdict after Tom had tested the 12, he told me it was as good as any of his and to take it home and build a telescope! I did. I had the mirror tested again by Joe Miller, who then taught mirror making at the L.A. club (who later became the director of the Lick Obs) he said it looked very good, probably better than tenth wave. This thing saw first light August, 1957, (Jupiter) unfortunately a couple of months too late for the high school science fair, as I had already graduated in June of '57.

The whole mount design revolved around a box of aircraft engine main bearings from the old DC-3. My dad was able to get these from his work at Western Airlines. Figuring that bearings were expensive, and I now had enough for this thing we'd make everything else fit. The bearings were 7"OD X 4"ID. We made the pier from 6" diameter pipe, filled with cement and found 7" steel tubing, with about 1/8 wall for the bearing housings. 4" OD pipe, 1/4" wall, machined to fit inside of the bearings served as the shafts. these shafts were welded to the 7" housings and the polar axis was welded to a piece of the 6" pipe at the requisite 34 degree angle (the latitude of L.A.) and bolted to the pier via the big pipe flanges. This in turn is bolted into a half yard or so of cement in the ground. (The whole thing now leans at about a 6 degree angle to accommodate the latitude difference from LA to Denver)

The drive is a 12", 96 tooth worm gear, clutched to the polar axis, which carries a 10" driven R.A. circle. A 15:1 reduction to a 1 RPM motor completes the drive. A second motor doubles the speed and provides a 15 deg/hr slow motion to the West, the other button turns all the motors off for 15 deg/hr to the East. In addition a small reversible motor, via a differential, provides guiding at +/- ~ 3 deg/hour. The polar axis also carries a 7" Hour Angle circle. The Declination slow motion is a manually operated tangent screw with the equivalent of a ~3675 tooth gear. The slow motion and clamp for the declination are operable from the eyepiece through long shafts and a gear system. The dec. circle is 15" in diameter and can sort of be read from the eyepiece. A 18"X44" or so plate is welded to the dec. shaft and carries the saddle for the tube assembly.

The 14"DiaX106"long tube is of 18 gauge galvanized steel, reinforced with 14" piston rings from an old diesel powerhouse engine. The mirror cell is sort of the standard two triangle design made from 1" thick aluminum plates, separated by a push-pull screw system. No springs! My first one was 1.5" plywood with really hefty springs, but it wouldn't hold collimation! This one has a 9-point flotation and three radial supports and seems to stay put just fine. The eye end consists of a 7" X 8" plate with four bolts on which the focusser, camera and whatever else can be attached over a four inch opening in the tube. I didn't want to be restricted by a small 1.25" or even 2" opening

The 1.25 focuser was the only purchased component (except the 2" diagonal, eyepieces and fi objectives) and was the first to give up. I made a new 2.4" focusser with adapters for 2", 1.25' assortment of other oddball sizes. Other accessories, built over time, include a special adapter for a 38mm Erfle, several planetary and direct focus cameras and camera adapters, a spectrograph and an adapter for the video camera. The 2" diagonal fully illuminates a 20mm diameter field, but works satisfactorialy with the erfle at a field diameter of 52mm. Although the illumination at the edge of this field is only 45% the views at 1.2 degrees are fine.

The finders are a 13X60 near the bottom of the tube and a 24X80 near the eyepiece as well as a couple of peep sights. The guide 'scope is a 4.25" f/22 Newtonian, whose focal length is very close to that of the 12. A real bear of a mirror! It was almost impossible to control the focal length, so I ground it flat through #220 grit, on the garage floor, and then used the #220 to generate the curve. Slowly and carefully.

All the parts, including bearing holders, and optics, were hand made as we had no machine capabilities. My dad borrowed a welding outfit and the two of us built this thing using the blacksmith arts! Weld it on, bend 'till it works and if it doesn't, cut it off and try something else. Those machine jobs on the shafts, and large welds, were farmed out to a local shop. I later learned one of my biggest goofs was not learning the machine shop arts. I took the cure for this, at the hands of a benevolent neighbor, and subsequent parts for this 'scope, including the new focuser and a new drive were from my ALM era. (After Learning Machineshop) I convinced my dad early on that we couldn't live without a lathe, mill, drill press and all. I still don't have a mill, but my dad and I split the cost for the rest of the stuff. An interesting note is that merely wanting to look at the stars can lead in all sorts of unimagined and expensive directions!

My major mistake on the first 6", aside from inexperience, was being in a rush. I had to have it done for the next close approach of Mars, and one lesson learned is that one doesn't rush a precision job like a telescope mirror. On the 12, I adopted a much more laid back approach. I had a fine 6" and I would be overjoyed at having a 12, but if it didn't work out, at least I'd still have the 6. I took it slow and easy, and it was a success. One of the major uses for this instrument was Lunar and Planetary photography. I had published several articles in the early '60s on that subject in The Strolling Astronomer (ALPO journal), Vol. 15 #9-10 Nov. 1961, Vol 16 #7-8, Aug. 1962, The Griffith Observer (Griffith Observatory) Feb. 1961 and Jul. 1965 and Sky and Telescope, July 1959.

Major mistakes were: 1) no rotating tube or upper section. This was sort of by design. If the tube rotates so does the field of view. Bad. (This is an excuse) We had no idea how to facilitate a rotating tube when building this thing. (This is a reason!) This makes getting to the eyepiece an interesting chore in some parts of the sky. Cure: If I were to do it again, Install some sort of rotating part at least for the eye end. 2) Ball bearings. Not enough friction which causes wiggle, and required friction pads inside the bearing housings. This was a lesson taught, learned but ignored, from the 6" mount. Cure: Lapped babbit bearings, if I were to do it again. 3) welding shafts directly to bearing housings. Doesn't allow for adjustment of orthogonality of axes and optical axis. Cure: Weld flanges on the shaft ends and housings. Machine to 90 deg. angles and bolt together, with shims if necessary. 4) Tube too small. The clear aperture of this thing is 12.6", the tube is slightly under 14" inside. With the reinforcing rings the clear path is 13.3" . Thermal currents are the kiss of death! Cure: a larger tube. The "Tombaugh criterion" is 1.5X the aperture 19" in my case. Easier things are vent holes (already done) and insulation (to be done in the near future)

When I built this thing it was one of the biggest. A 12.5" grinding kit was $48, the blank, $21. A 16" blank alone was $175, so "aperture fever", when tempered with the realities of the dollar, stopped at 12.5. 16s were rare and I knew of only one 18". One must realize these things are never finished. There are all sorts of fixes, modifications and the like that go on forever. This monster has given me over 40 years of service and pleasure, and hopefully many more to come.

F. Jack Eastman