Portable Telescope Stand

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Background:
Had a 10” Meade LX200 f/6.3 scope but not a wedge, and did not want to buy one even though I wanted to do astrophotography. I also lived in the center of the Los Angeles Basin, so I had to transport my scope to the surrounding mountains. I found it took about 20 to 30 minutes to set up a conventional Meade scope. This entailed setting up a tripod, carrying the OTA assembly and bolting it to the tripod. Then electrical and optical adapters and finders had to be set up and aligned prior to observing.

Criteria:
I wanted a fully assembled portable tripod that had the scope already attached, with all accessories ready to go (mainly tube weights and 2 finders. The stand needed to be adjustable for latitude, thereby negating the need for a wedge. The stand had to collapse as small as possible to minimize the room it occupied in the vehicle or in the garage. The stand needed to have eyepieces and accessories at hand, and ready to use. Eyepieces were to be stored in a horizontal position to reduce dew while observing. The original design was to incorporate a fixed eyepiece storage bin, but the desired position precluded complete folding of the unit during transport, and an removable accessory box was designed instead. An nice feature of this accessory box is the flat surface can be used as a map board when the lid is closed. I even added a clip board spring clip to hold maps or books open. Knowing how heavy the stand and scope would be, I wanted half the weight to be supported by the bumper or rear deck of the vehicle when unloading. I had a 1994 Ford Explorer, and a portable stand had to fit behind the rear seat. The stand was designed to accept an OTA as large as a Meade 12”, though I did not have a model to test to ensure a perfect fit.



The Design:
The resulting stand would be moved around like a furniture dolly on two wheels. Two small wheels were added in front to make insertion into the vehicle easier. A resulting advantage of the four wheels, however, is the stand can be stored in fully assembled mode in the garage, and pushed to a observing position outside without have to readjust for latitude. The stand should have shock absorbers or cushions on all floating joints to reduce vibration during transport. I was able to find round blue cushions of foam with a center hole for a screw that had the requisite density and shock absorption. (McMaster Carr, "PVC Mount" part number 60525k13, pg 1074, Catalog 106. They cater to industrial and large lot purchases, so I went through my work account.) When the scope rides in the back of the Explore, there is no rattling.



Storage Position

Latitude adjustment was accomplished by a large 1.5” aluminum bolt with 4 threads per inch. This had to be machined at a machine shop, along with the matching “nut” that is fixed to the stand. Adjustment is achieved by turning the bolt as many times as necessary to raise or lower the unit to meet true north. This screw assembly is the most time consuming part of assembly. And, even though turning of the screw can be roughly achieved before erecting the stand, when the unit is still collapsed, it still takes too much time. I could not come up with a fast acting screw design and still maintain rigidity. There is room for improvement here. The screw needed to be screwed in every time prior to transport, as it can not protrude beyond the bottom of the stand when moving.

The wooden yoke used to support the scope pivots up when in working position. It was made of 1.25” thick mahogany. Mahogany was used for all exposed wooden parts because (1) it is relatively resistant to moisture (even though all wood was sealed with polyurethane), (2) it is fairly light in weight yet with good strength, and (3) it is easy to work. I tried steam bending the yoke, as it’s lower pivot point has some interesting geometry. The design demanded an “S” shaped yoke to be perpendicular to all axis. But, mahogany did not bend well at all, and in fact the pieces split when bent very far at all. I was required to redesign with all straight pieces on the main yoke. I did achieve a slight bend on the back yoke that holds the latitude adjusting screw. That bend was necessary, but was still not as tight as I wanted. I would recommend a different wood such as oak or ash for bending as they are known to bend under steam much better than mahogany.
I changed the design, and moved the yoke to the inside of the vertical supports. I wanted the yoke to stay outside of the vertical supports, but was surprised to find the yoke would not bind while raising. Hence the yoke MUST be inside the vertical supports. I glued wooden wedges at each end of the yoke (both sides) so the axles are all perpendicular to all pivoting surfaces.



Scope in collapased position



Scope partial erect with latitude adjustment arm in place

Two supports had to be added to the yoke to accommodate the weight of the OTA when collapsed. The two “ears” on the inside of the yoke where topped with blue rubber cushions, and are needed when erecting the stand.



OTA in position

Leveling of the stand uses three 0.5” stainless steel bolts. The two north bolts were 20” long and run through the height of the north supports. This added height makes for easy leveling when setting up the scope without having to bend down to ground level. The south bolt is only 5” long, and is hidden behind the large latitude adjusting bolt, and is only accessible when the scope is erected.

The power supplies are built into the base. I attached a 25’ cord reel to more easily store the cord. I found a German made variable power illuminator I attached near the base of the scope to help with accessories and map reading. The light is 120 volts, and plugs into the cord reel. I am sure this unit was not made for exterior use, and will probable short out and kill somebody someday. Until then, though, it is very convenient. The lamp is white, so I purchased some red cellophane to change the color. However, I never found a way to hold the cellophane over the lamp housing successfully. Rubber bands would have melted from the heat of the lamp. It is nice to have white light when setting up, and I just turn down the intensity when observing to minimize dim light adoption.



OTA and stand in fully erect position ready to polar align

Loading for Transport

I was SO happy when I first loaded and unloaded the stand. Half the weight of the unit is truly supported by the rear bumper or tailgate when lowering or raising the stand. I added handholds (cutouts) to the rear or north supports to aid handling. Even though this stand weighs more than a tripod and Meade scope combined, half the weight is still less than the OTA on its own, so the unit is easier on the back when moving.

Erecting the Scope

I have never had problems here. It just takes time. Find the observing location and rest the scope on all four wheels. Screw the two south leveling screws down to make contact with the ground. You don't want the unit moving on the wheels when you raise the yoke. Now unscrew the latitude adjusting screw out to where to about the length you used last time. Now, raise the yoke and position the end of the latitude adjusting screw into the small depression on the base. Now, lift the OTA into position. There is one bolt that holds this base board and OTA upright. The scope can now be readied for use.

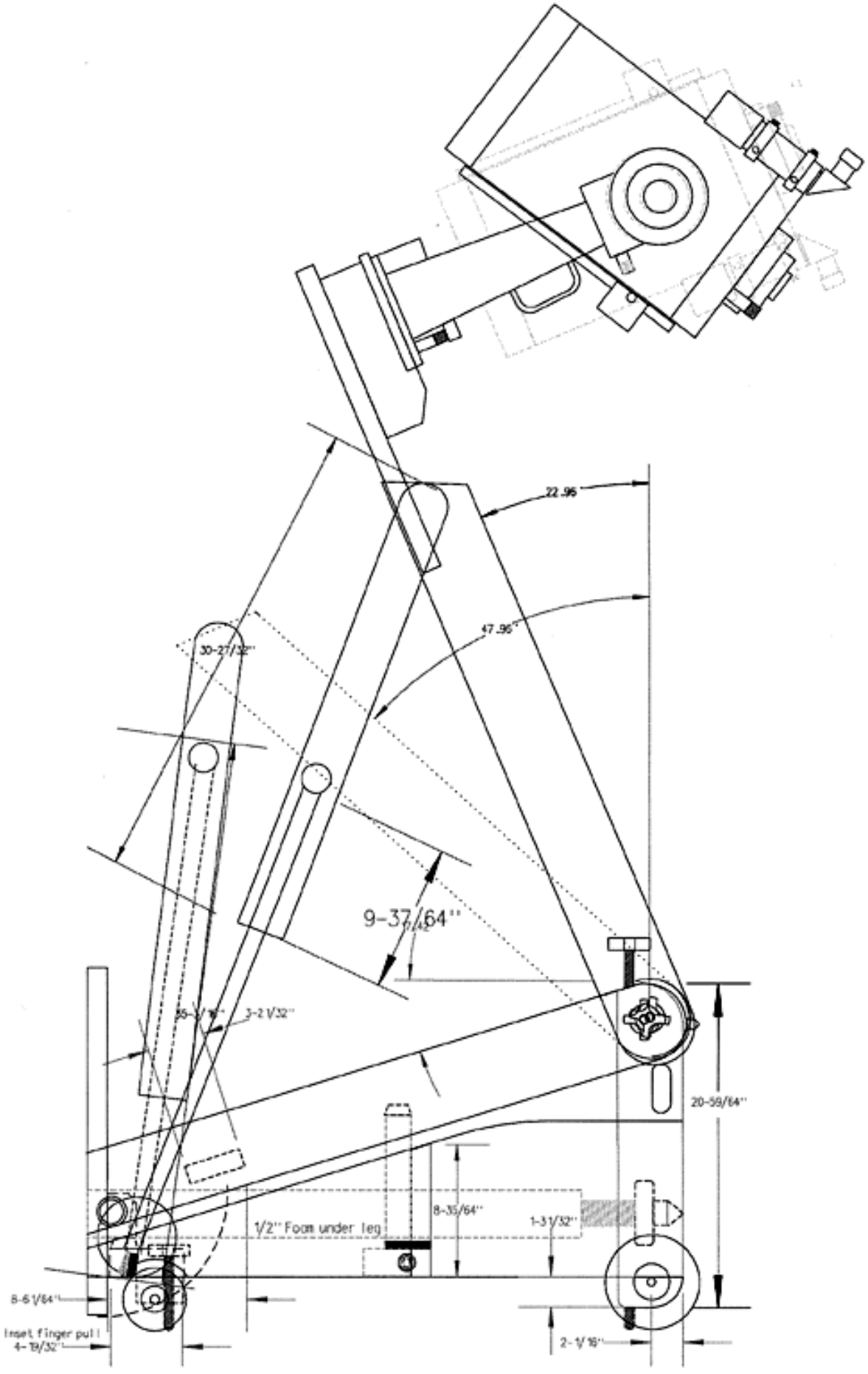


Close-up of the accessory tray

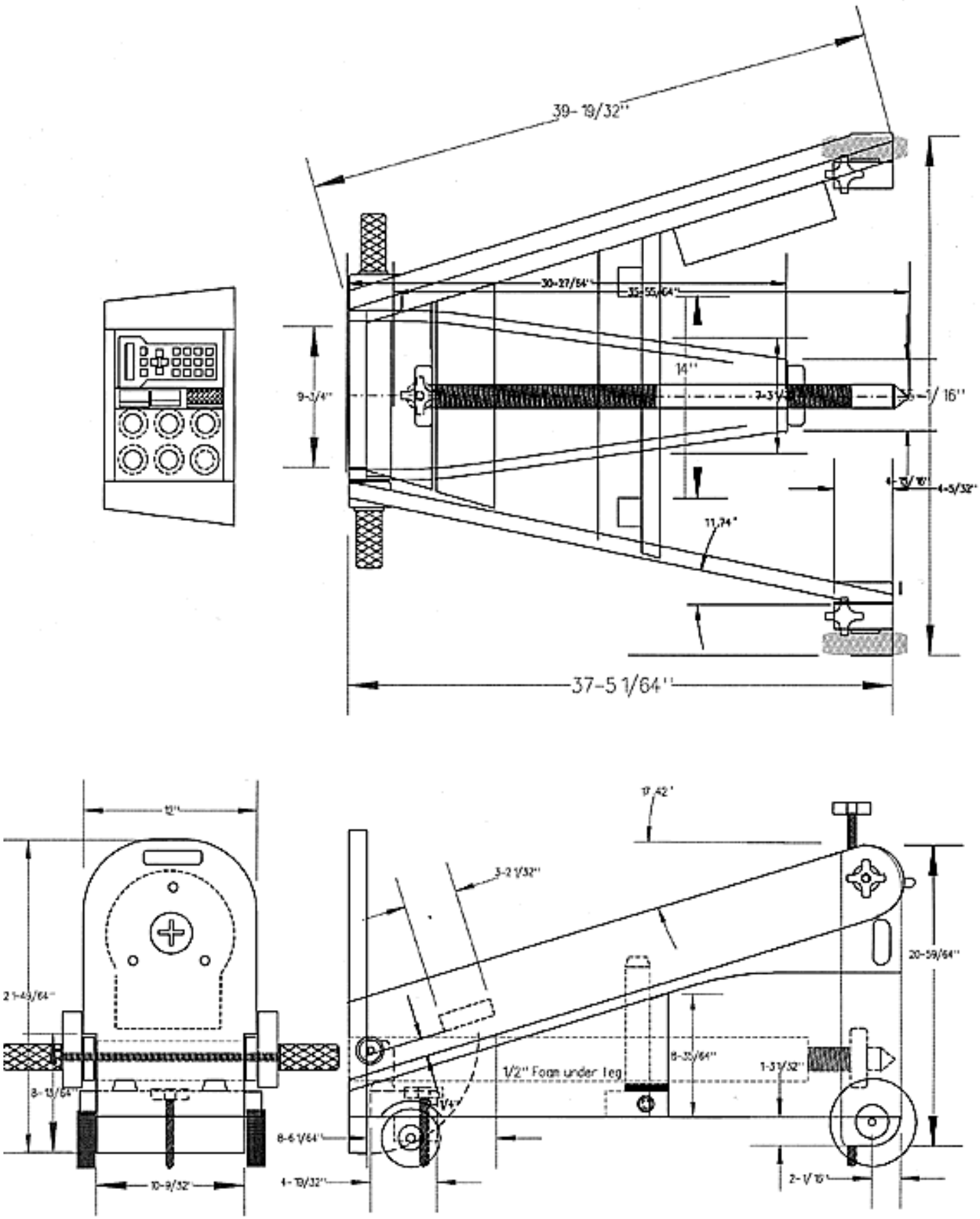
Polar Alignment
Latitude adjustment is easy. You can sight through the scope at the north star and still reach the top of the latitude adjusting screw. There is a “T” handle for turning. Knowing where the north star is in relation to the true north helps, and that is basically a function of the time of day.

Aligning east or west is more difficult. You have to lift the south end of the base, and move right or left. You only move it in small increments, but is pretty crude. However, I was happy to find the amount of movement was easy to gauge with just a little practice, and my first alignment took only a few minutes.

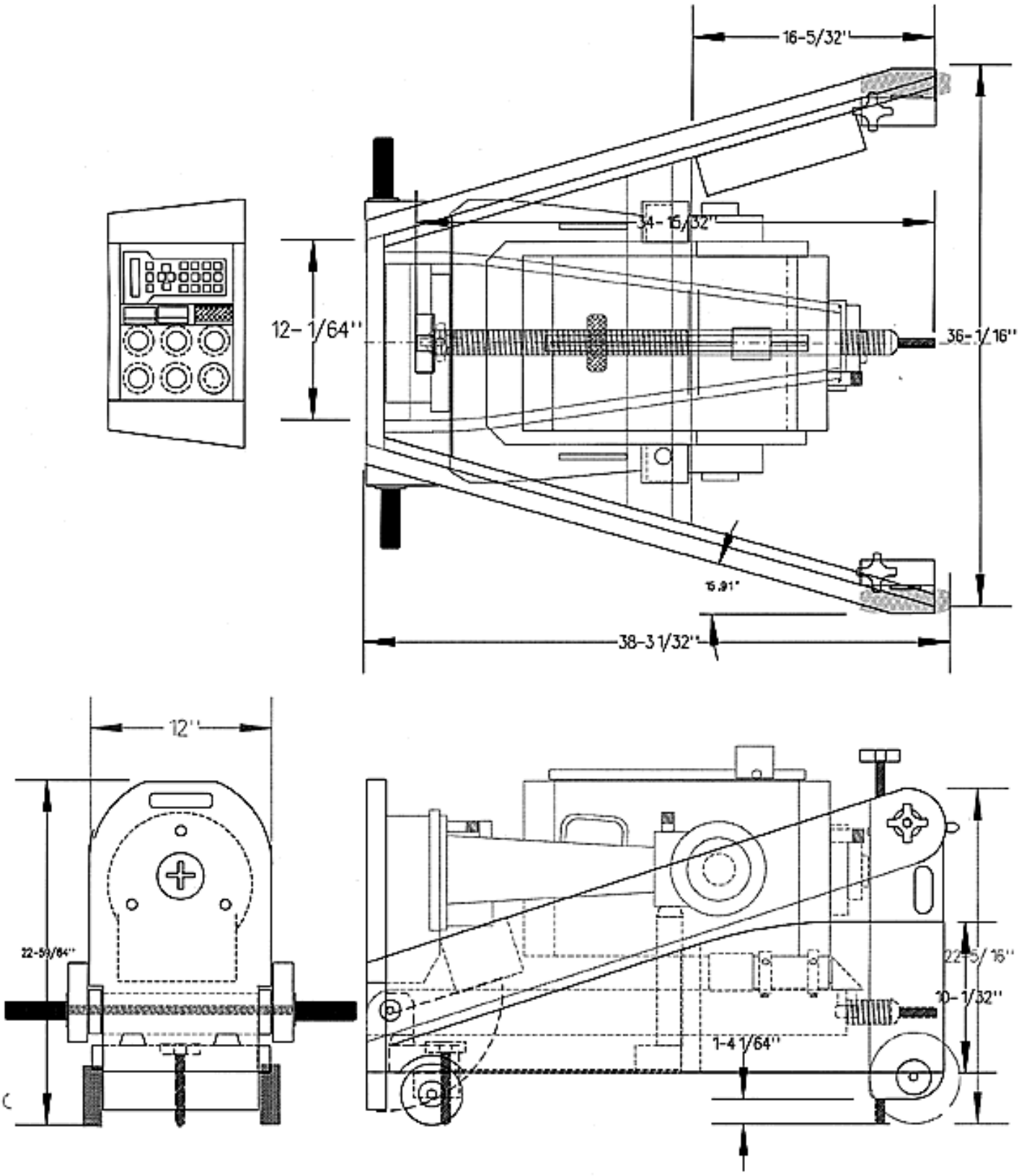
Operation
Stand to the north end of the scope, install eyepieces and diagonals from the very accessible box, use the variable illuminator as you wish, close the accessory lid, and use the flat surface as a map board, and observe.
Mechanical Drawings:


22.96
47.96
30-27/32"
9-37/64"
3-2 V32"
20-59/64"
8-35/64"
1-31/32"
1/2" Foam under leg
8-61/64"
Inset finger pull
4-19/32"
2-1/16"

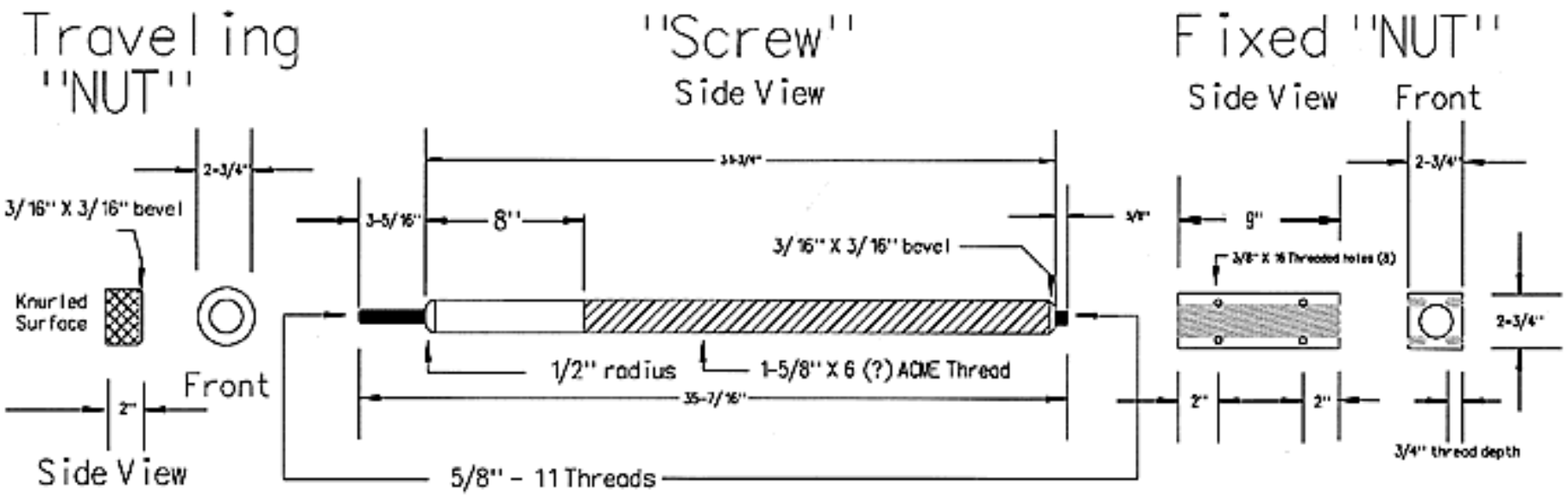
Drawing 1

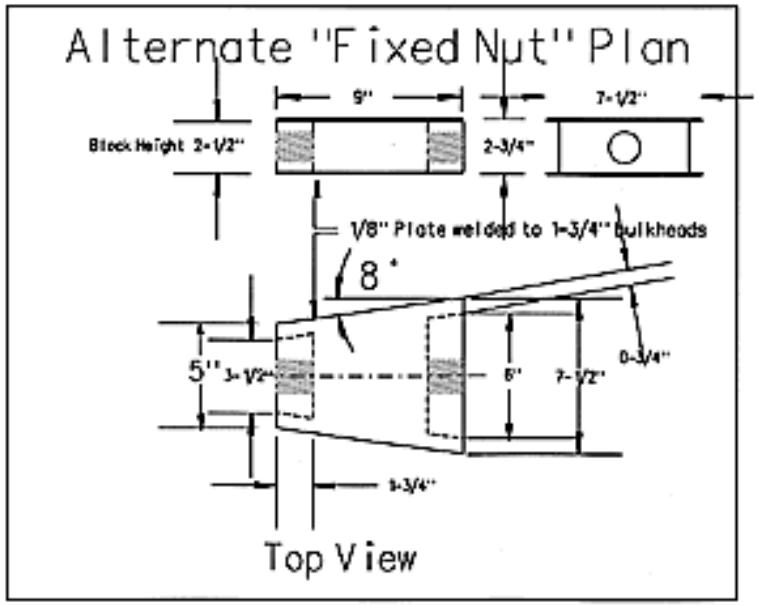

39- 19/32''
30- 27/64''
35- 55/64''
14''
9-3/4''
37-5 1/64''
11,74°
4-5/32''
12''
21-43/64''
8- 13/64''
10-9/32''
3-2 1/32''
19,42°
20-59/64''
1/2'' Foam under leg
8-35/64''
1-31/32''
8-6 1/64''
4- 19/32''
2- 1/16''

Drawing 2


16-5/32''
34-15/32''
12-1/64''
36-1/16''
15.91''
38-31/32''
12''
22-59/64''
22-5/16''
10-1/32''
1-41/64''

Drawing 3





Part : Telescope Elevation Adjustment Screw

Material : All 3 pieces of Aluminum

Drawing 4