

# Hubble Optics Ultra Light UL 14 Dobsonian instruction manual

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Please read these instructions thoroughly before beginning assembly and subsequent use of the telescope.

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**WARNING: Never look at the sun with your telescope without a professionally made solar filter. Permanent eye damage or blindness could result. Eye damage is often painless, so there is no warning until it is too late. Children should not be allowed to handle the telescope. Avoid using the type of solar filter that screws into an eyepiece. They are susceptible to cracking under the intense heat that builds up near the focus point, and could cause severe retinal damage. Use only the type of solar filter that covers the front of the telescope. Also, be sure to leave the cover caps on the finder scope when solar observing. Better yet, remove the finder scope altogether when viewing the sun.**

# 1.Unpacking

The telescope is packed in three shipping boxes, as described below. We recommend keeping the original packaging for the future usage.

Make sure all the parts in the Parts List are present. Be sure to check all boxes carefully, as some parts are very small. If anything appears to be missing or broken, immediately email Hubble Optics for assistance.

Box #1, The UL14 main structure

<b>Quantity</b>	<b>Description</b>
1	Mirror Box/Rocker/Ground board
1	Upper ring
3	Spider Vanes
1	Secondary spider hub (with screws attached) and the diagonal secondary mirror holder
1	Mirror Box, Rocker, and “Ground Board”
1	Focuser L bracket (with 2 M5 x 16 screws)
1	Secondary mirror
1	2" 8:1 dual speed focuser
3	Plastic feet with wing nuts
4	M6 knob screws (20mm long) with wingnuts for the truss tube and upper ring connection
8	M6 knob screws for the truss tube and mirror box connection
4	M6 knob screws for the ALT bearing bracket
1	Magic nylon tape to hold the sling
3	Brass wire to evenly separate cell support bars
1	Nylon sling belt
6	Mirror Cell Protection Pad
1	8 x 50 finder scope and bracket (option)
1	Shroud (option)
1	Truss Tube Carry Bag (option)
1	5-star artificial star (option)

Box #2: The primary mirror

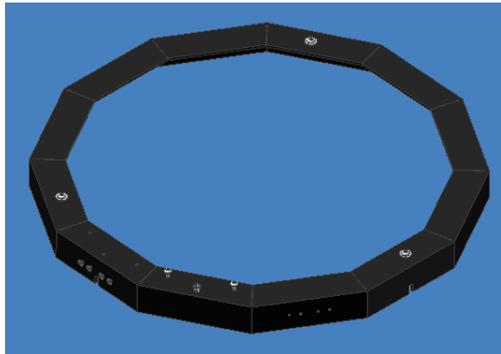
Qty.	Description
1	Primary Mirror

Box #3: Truss Tubes

Qty.	Description
8	Truss Tubes



**Figure 1: Mirror Box**



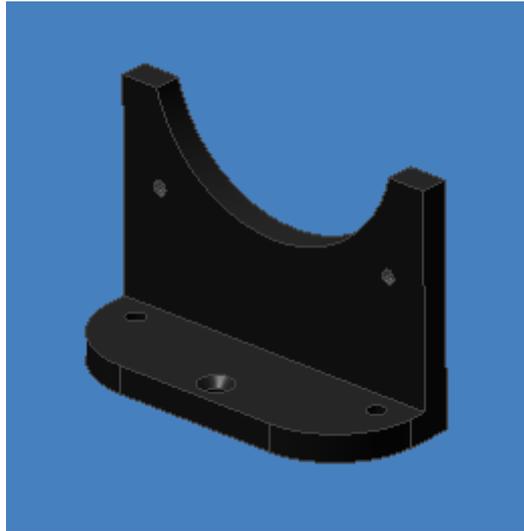
**Figure 2: Upper Ring**



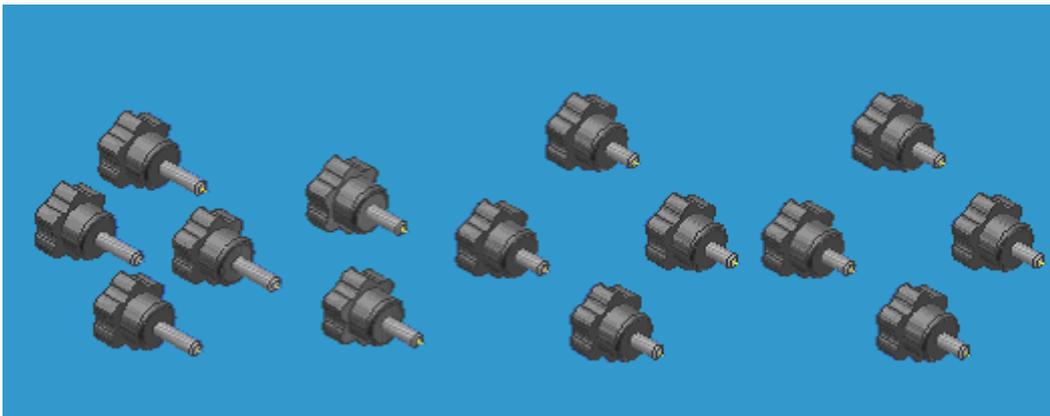
**Figure 3: Spider Vanes**



**Figure 4: Secondary Spider Hub/ Diagonal Support**



**Figure 5: Focuser L Bracket**



**Figure 6: 14 Knob Screws**



## 2. Assembly

Now that you have unpacked the boxes and familiarized yourself with all of the parts in front of you, it's time to begin assembly. You'll need a regular screwdriver, a Phillips screwdriver, a set of metric hex keys (1.5, 2, 2.5, 3, 4, and 5mm), two 6-inch (150mm or smaller) adjustable crescent wrenches, and a scissor.

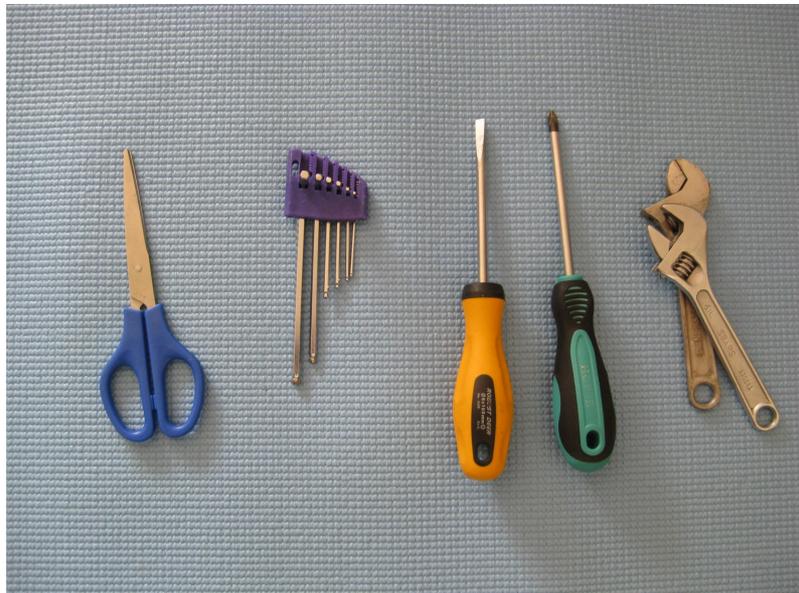
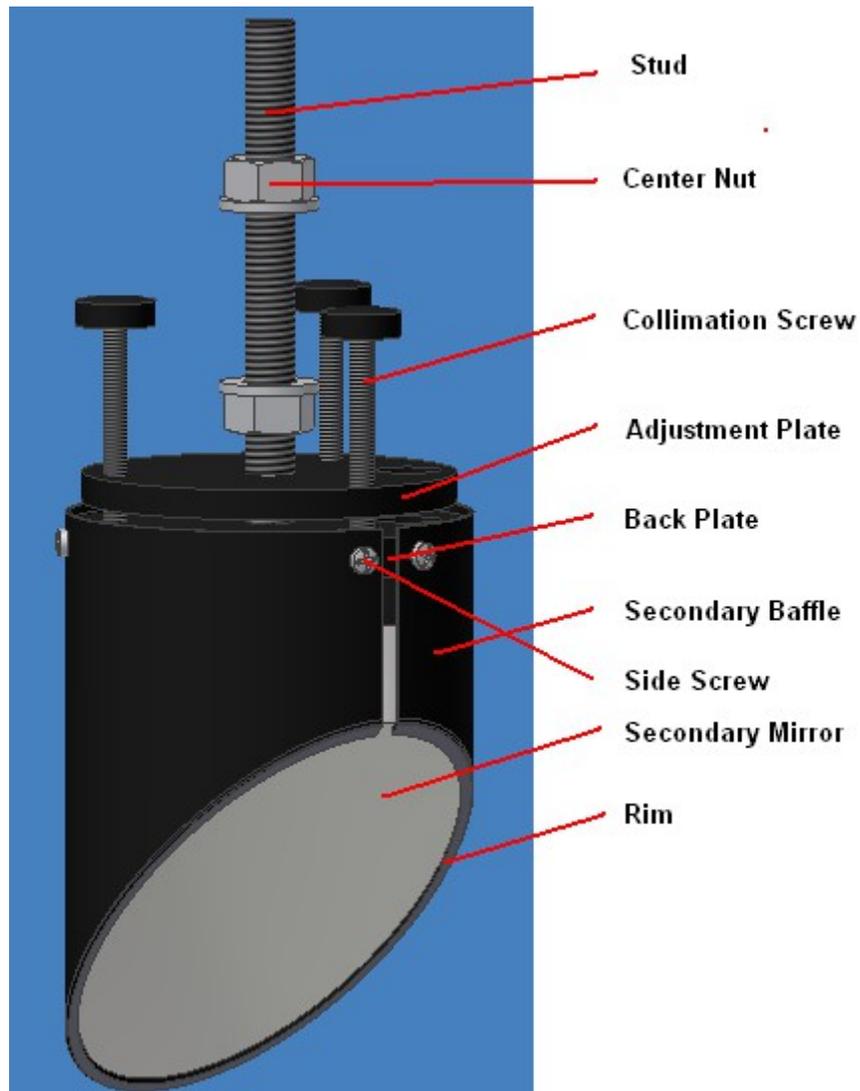


Figure 7: Tools Required (Not provided)

### 2.1 Install the Secondary Mirror

#### 2.1.1 Install the Secondary to the diagonal holder

The Secondary baffle is made of the thin aluminum, please handle the mirror and the baffle with care! First, remove the 5 small side screws holding the secondary baffle. Open the baffle slightly, and carefully slide the secondary mirror into the baffle from the back; let the mirror lightly held by the baffle's rim. Then place the fiber fill behind the secondary mirror to support the mirror. You should place enough fiber packing behind the secondary to hold it snugly in place but don't over-pack it; otherwise it cause distortion of the secondary mirror. Then re-install the 5 small screws to secure the baffle and the secondary mirror to the back plate.



## 2.1.2 Install the Secondary Mirror Cage

Please note that most screws needed for the installation are already installed on the parts for easy identification.

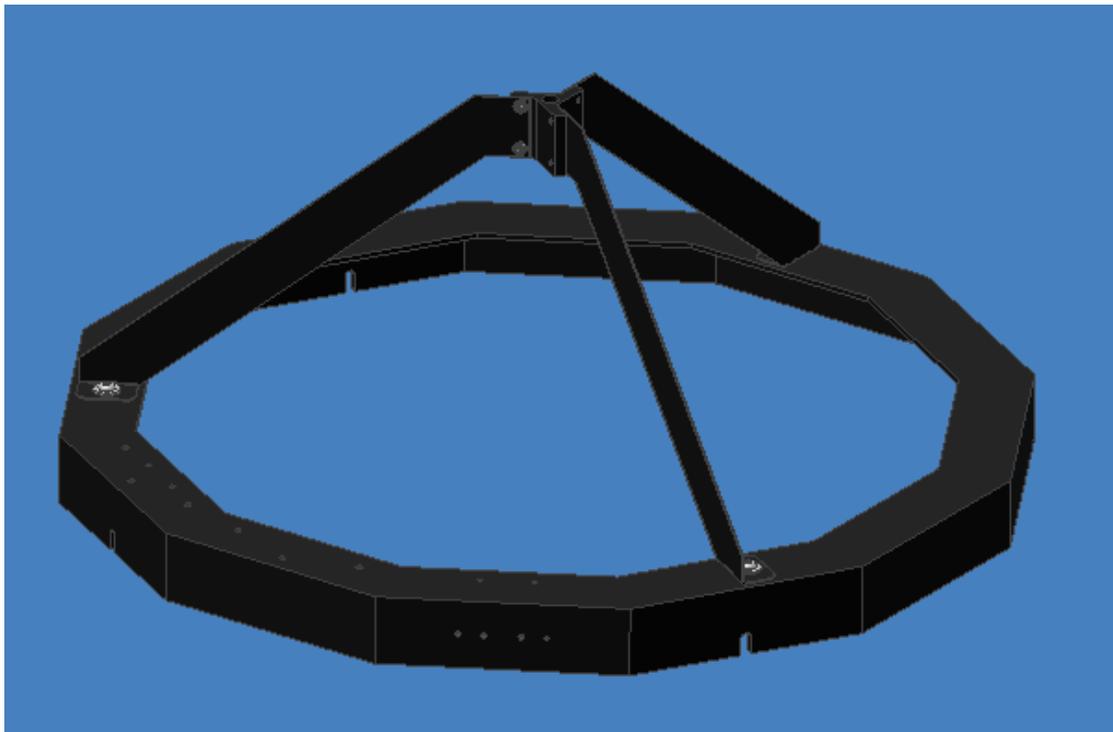
You do not need to have the scope completely set up to carry out this step of assembly.

- Attach the three spider wings to the spider holder
- Attach the three spider wings to the upper ring
- Attach the focuser L bracket to the upper ring and tighten the screws
- Attach the focuser to the L bracket and tighten the screws
- Attach the secondary holder with the secondary mirror (installed and cured)
- Roughly adjust the center bolt and the orientation of the secondary holder until the secondary mirror is centered by being viewed from the focuser draw tube

- Adjust and tighten the three collimation screws.



**Figure 8: Attach the three spider wings to the spider hub**



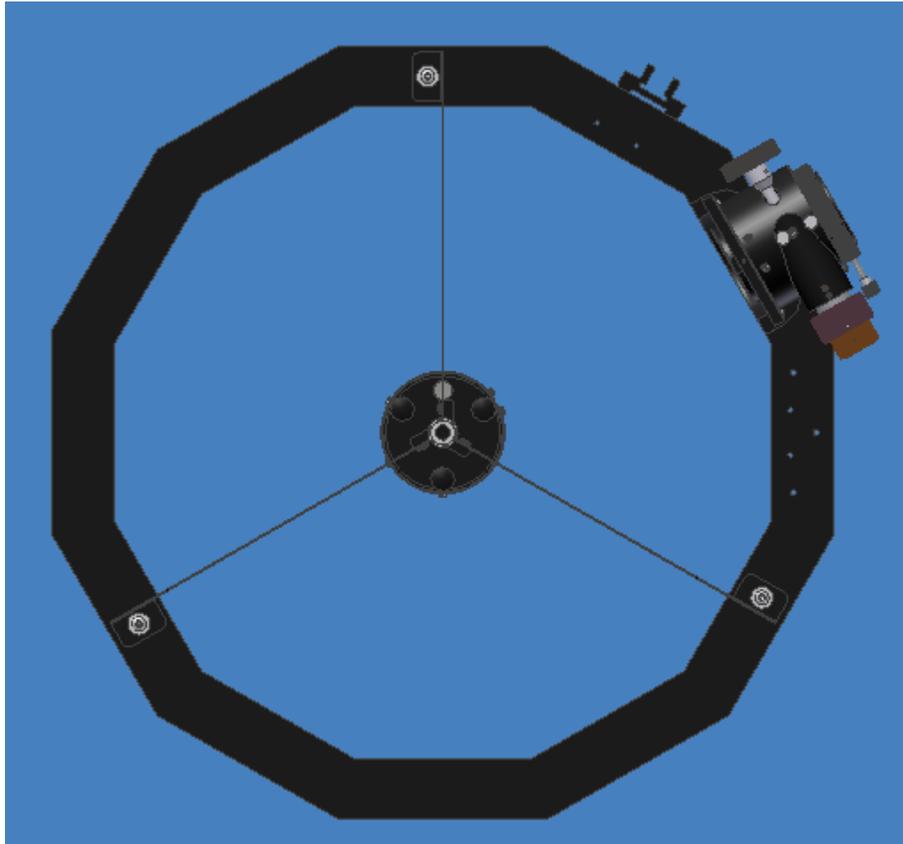
**Figure 9: Attach the three spider wings to the upper ring**



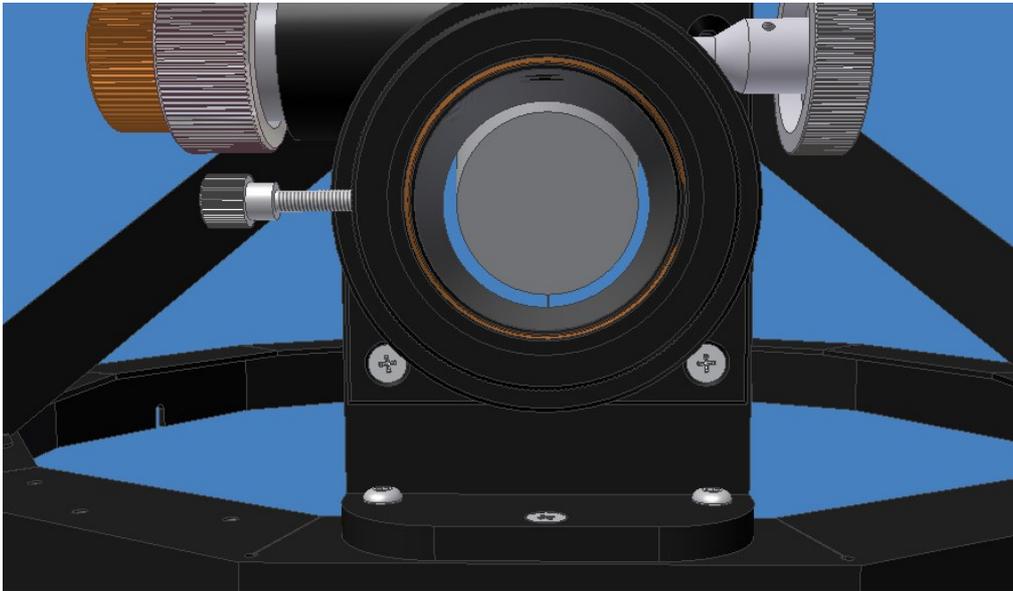
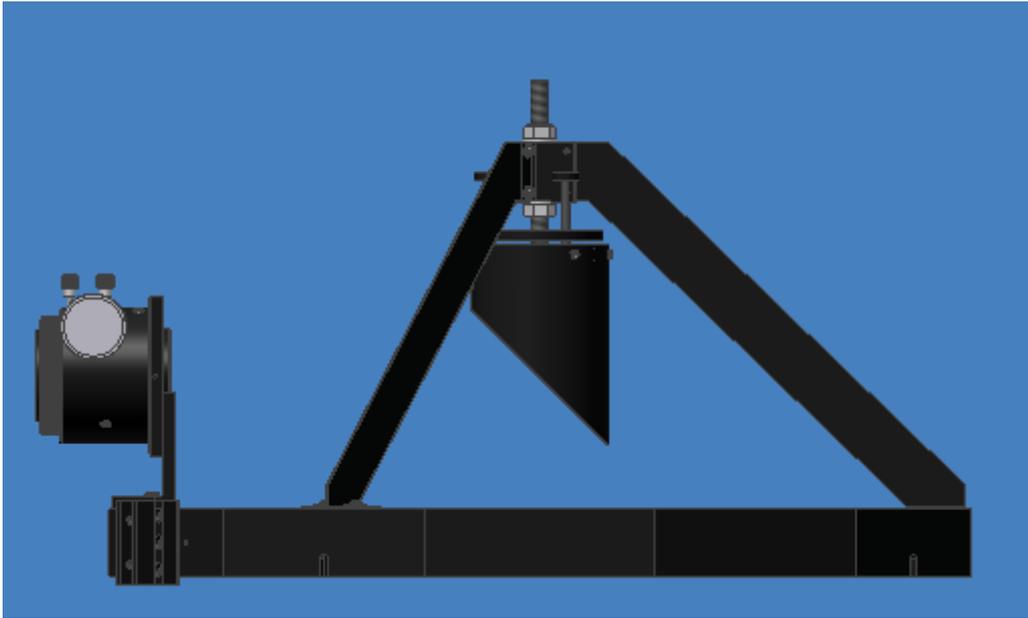
**Figure 10: Attach the focuser L bracket to the upper ring**



**Figure 11: Attach the focuser to the L bracket**



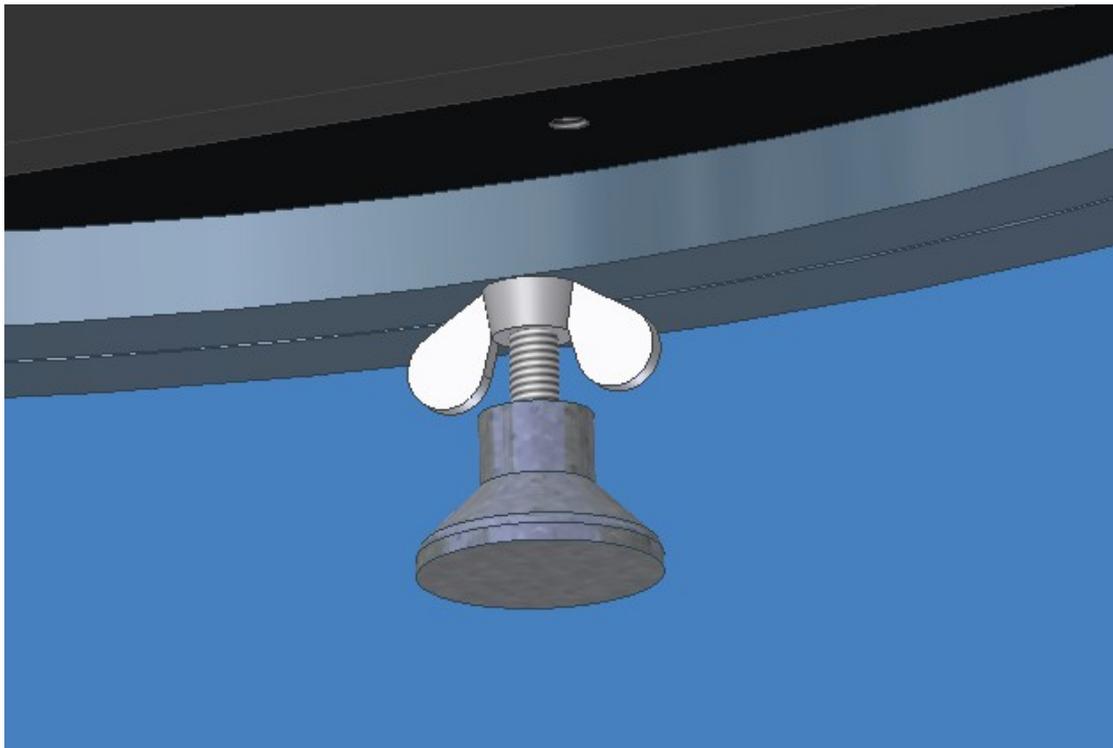
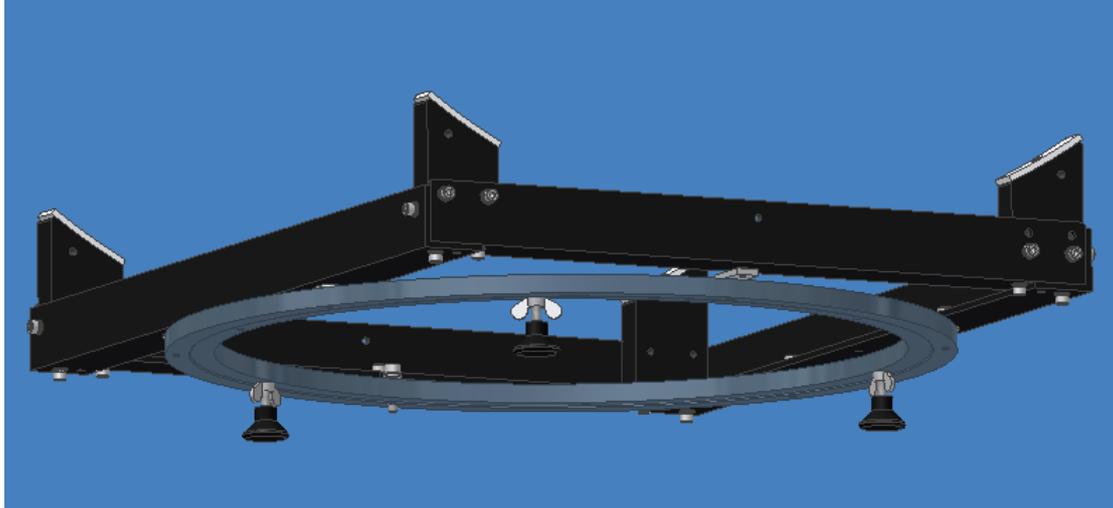
**Figure 12: Attach the secondary holder with the secondary mirror**



**Figure 13: Center the secondary in the focuser drawtube**

## 2.2 Assembly of the Dobsonian Rocker

The UL14 base is shipped assembled. The only thing you need to do is to install the three plastic feet. Make sure to use the wing nuts to lock the three feet.



## 2.3 Assembly of the Mirror Box

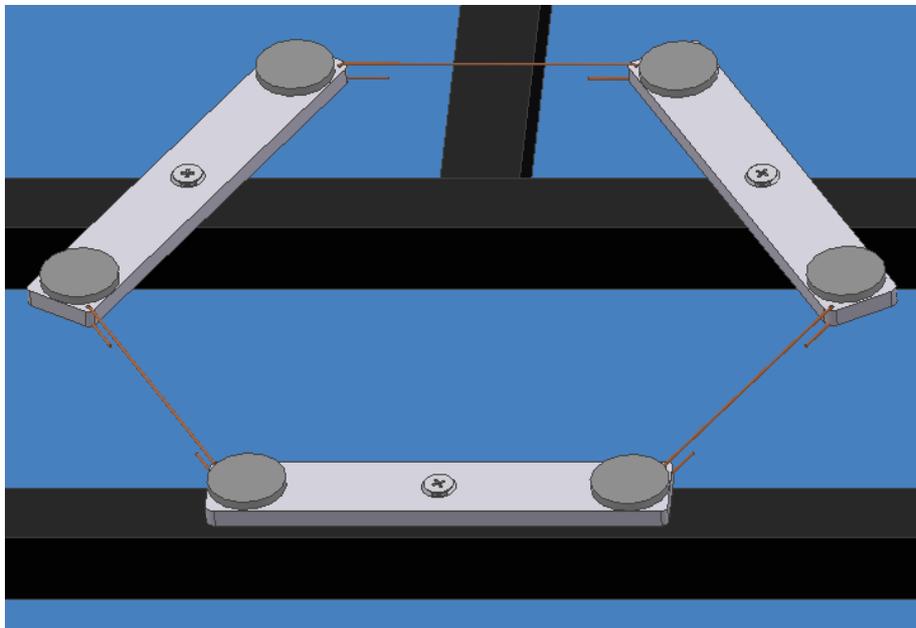
The primary mirror is shipped in its own box. Once the primary mirror is installed in the mirror box, there will be no need to remove it until cleaning is necessary. However, for shipping and long-term storage, the primary mirror should be packed tightly in its original packing.

The mirror box is mostly assembled already, but you do need to place the primary mirror into the mirror box.

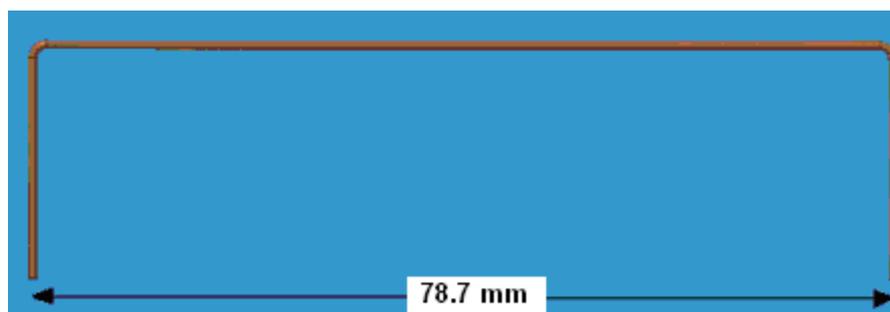
### 2.3.1 Installation of the Pads and Brass Wires

Before installing the primary mirror, you need to perform the following tasks:

- Attach the 6 adhesive scratch protectors to the three support bars
- Attach the three brass wires to regulate the support bars

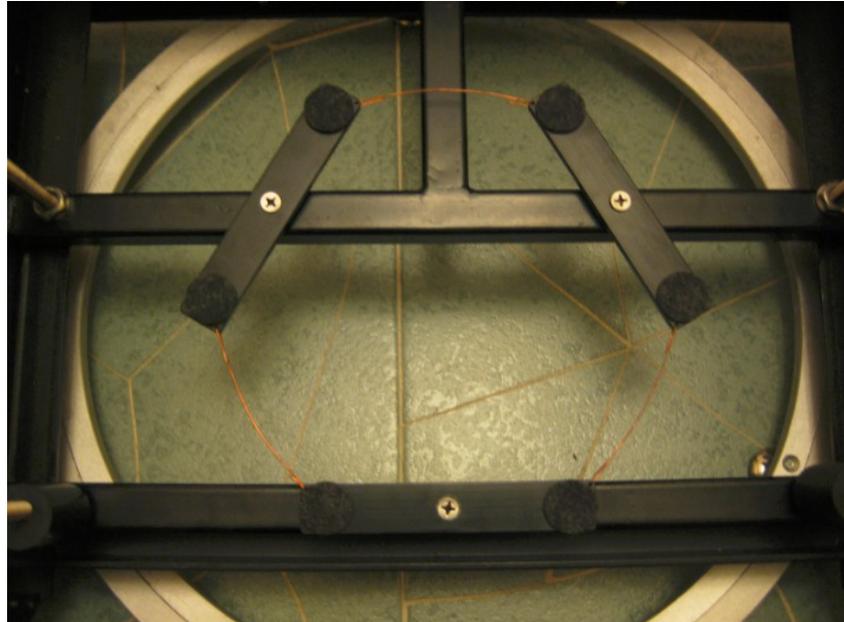


First bend the three brass wires into the following shape, with the center portion about 78.7 mm (a bit longer is OK, but all three should be the same length, as much as possible).



Insert the brass wires into the small holes on the support bars, and then bend and twist the head portions to lock the brass wires in the position.

Push the brass wires outward into a slight curve to keep the support bars in position.

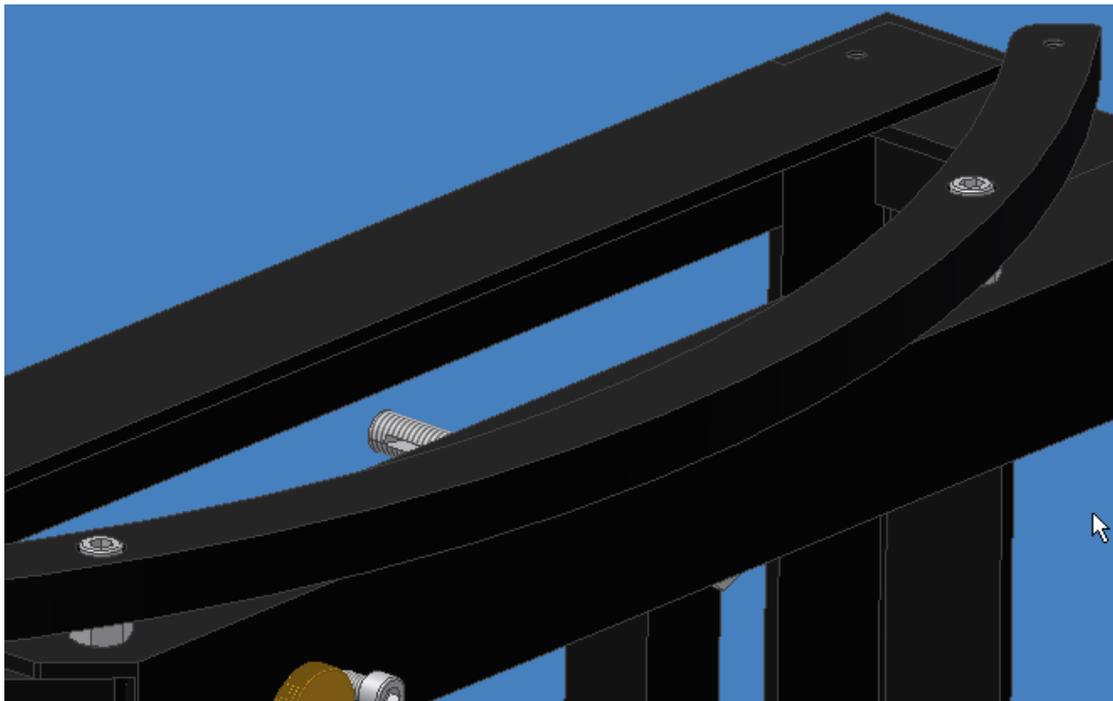


### 2.3.2. Installation of the Lower ALT Bearing Sections

Rest the Mirror Box on its side:



Place the two spacers around the ALT bearing installation holes. (Please note that the spacers are already installed).

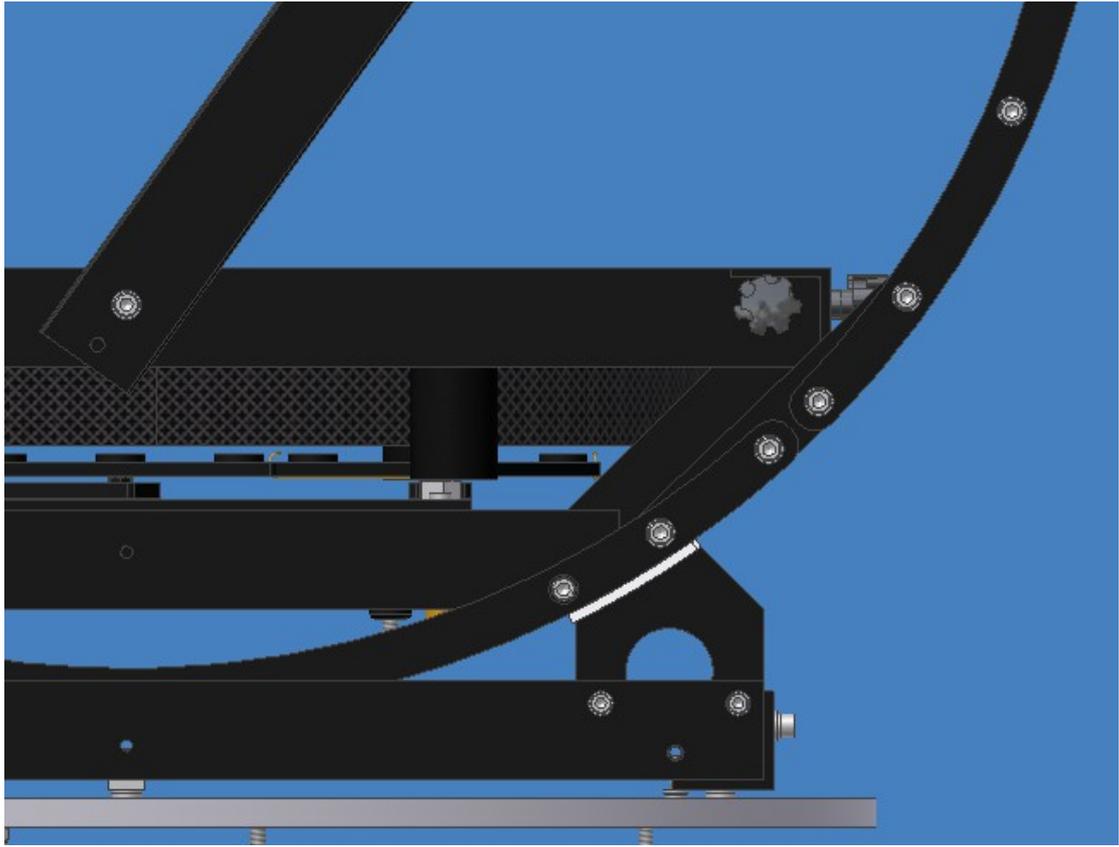


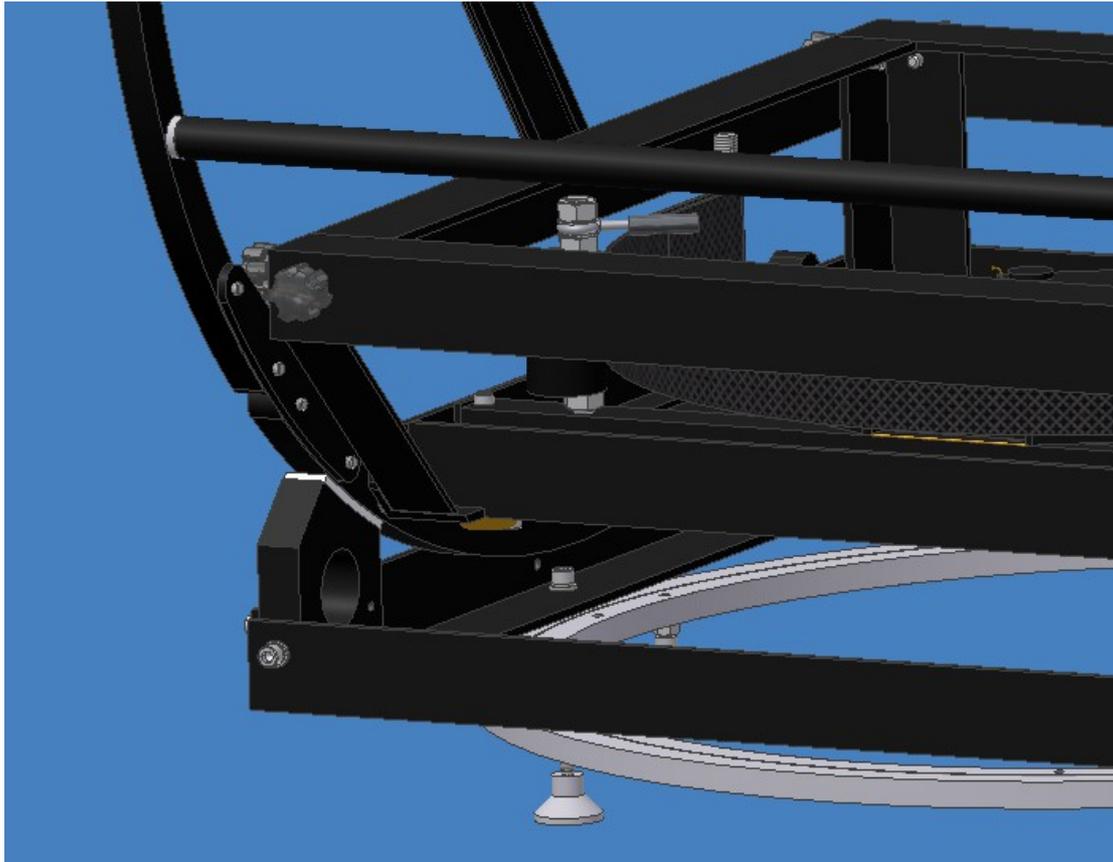
Then turn around the mirror box to rest it on another side to install another lower ALT bearing section.

### 2.3.3. Installation of the Upper Lower ALT Bearing Section

Place the mirror box onto the Rocker box.

Then install and bolt the ALT upper bearings sections one at time to the lower section. Then bolt the two cross tubes to the upper bearing sections.





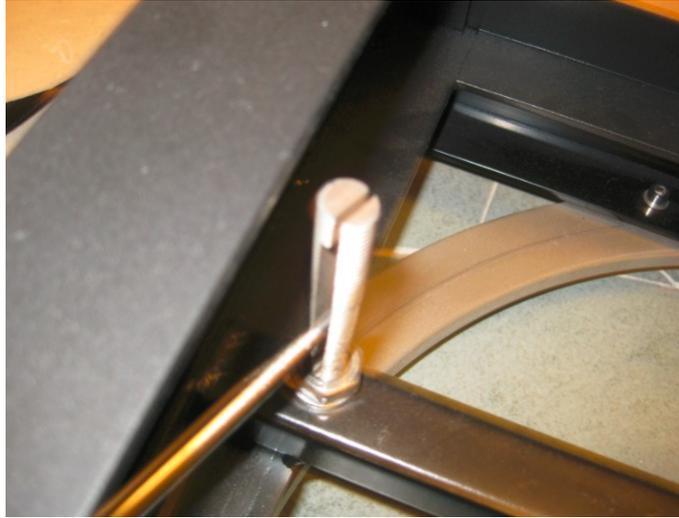
**Figure 14: Tighten the knob screw and pivot screw**

The mirror box can be stored and transported folded.

### 2.3.4 Installation of the Primary Mirror

Rotate the two eccentric side pins to make room for the primary mirror. Loosen the locknuts on the top of the mirror clips and turn them aside.

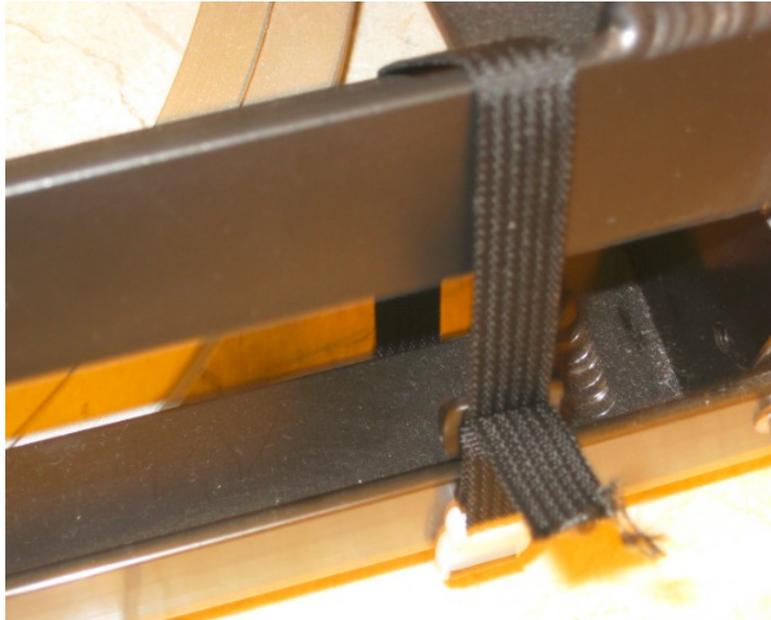
Use a flat head screwdriver to open the split bolts, and insert the sling into the slot. Also loosen the nuts on the two split bolts that hold the sling. Stretch the sling loosely around the two lower side pins.



**Figure 15: Open the slot**



**Figure 16: Insert the sling**



**Figure 17: Lock the mirror box to the rocker with nylon strips**

Make sure the mirror box is locked with nylon strips to the rocker. Also make sure that the three mirror support bars are evenly placed in the cell. Pick up the mirror and place it into the mirror cell. Check that the mirror is centered. Wiggle it a bit to insure that the cell parts are moving freely and adjusted to the float of the mirror.

Next, place the sling between the side pin and the side of the mirror. Rotate the two lower pin so there is 3-6mm between the sling around the mirror and the side pins.

The side pins should not contact the mirror during observation. If the primary touches the pins, adjust the sling and/or rotate the side pins that contact it. Tighten the nuts that hold the side pins.

The mirror-protecting clips should not contact the mirror at all. Keep the clips about 3-6mm above the mirror surface. Place the mirror clips over the mirror and tighten the top lock nuts.

At this point, the sling should be loosely around the mirror. On the lowest part of the mirror, which will rest in the bottom of the sling, place a short piece of the provided Velcro (Magic Nylon tape)

Make sure the sling is in the middle of the mirror, so there is equal amount of glass above and below it. The magic tape will prevent the sling from slipping off the mirror when the telescope is pointed straight up. Now, leave the sling loose, you will adjust it after the telescope is fully assembled.

- 1. Secure the mirror box to the Rocker with four supplied nylon strips**
- 2. Make sure the 3 support bars are evenly positioned**
- 3. Load the mirror into the cell**

**Once the mirror is installed, you should use a square cardboard (not provided) to cover the mirror box up.**

## 2.4 Install the Truss Tubes and Secondary Cage

### 2.4.1 Installation of the Truss Tubes

The truss tube ends have an asymmetric shape, so they can be connected in the following way to avoid interference with each other.



- Make sure that the primary mirror is fully protected with a mirror box cover, which can be as simple as a square cut out of cardboard.
- Connect two truss tubes with an M6 knob screw (20mm long) and an M6 wing nut on the multiple-hole side of the top end. The multiple holes are used for optimizing the OTA length for slight variations in focal length of the primary mirror. Normally, you should use the second hole from the top.
- Then connect each pair of truss tubes to the mirror box with two M6 knob screws (14mm long)



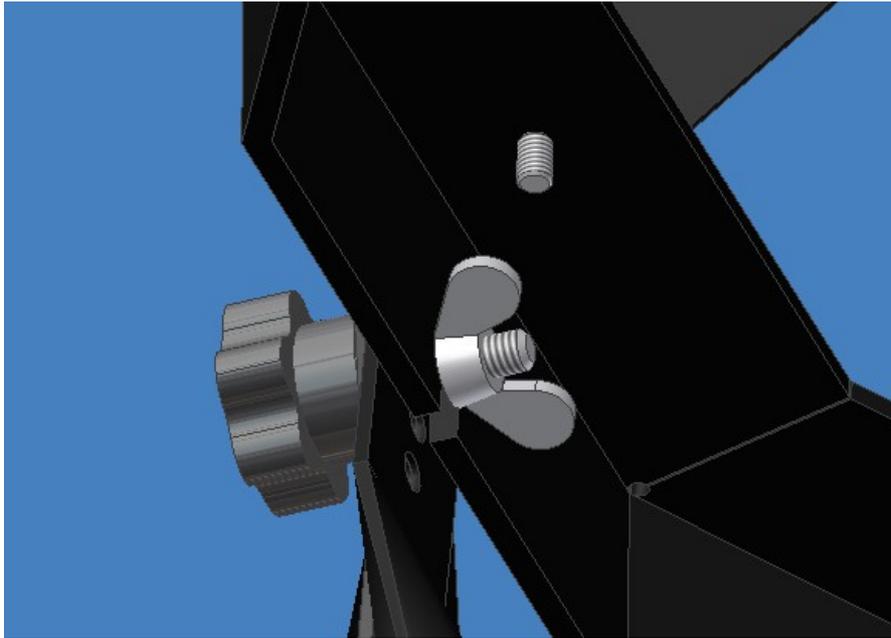
**Figure 18:**Tighten the knob screws



## 2.4.2 Installation of the Secondary Mirror Cage

Here is the installation procedure:

- Make sure that the primary mirror is fully protected with a mirror box cover, which can be as simple as a square cut out of cardboard.
- Loosen the wing nuts on all the knob screw as much as possible, but make sure they are still fully engaged on the bolts.
- Hold the secondary cage up, and slide one of the slots on the upper ring into the top knob bolt of one truss pair. Make sure you slide the slot into the space between wing nut and the truss tube ends.
- Then slide an adjacent slot into the knob bolt of the corresponding truss pair.
- Then slide the remaining two slots into the rest two knobs bolts at the same time
- Finally tighten all knobs & wing nuts.



**Figure 19:Slide in one slot first**



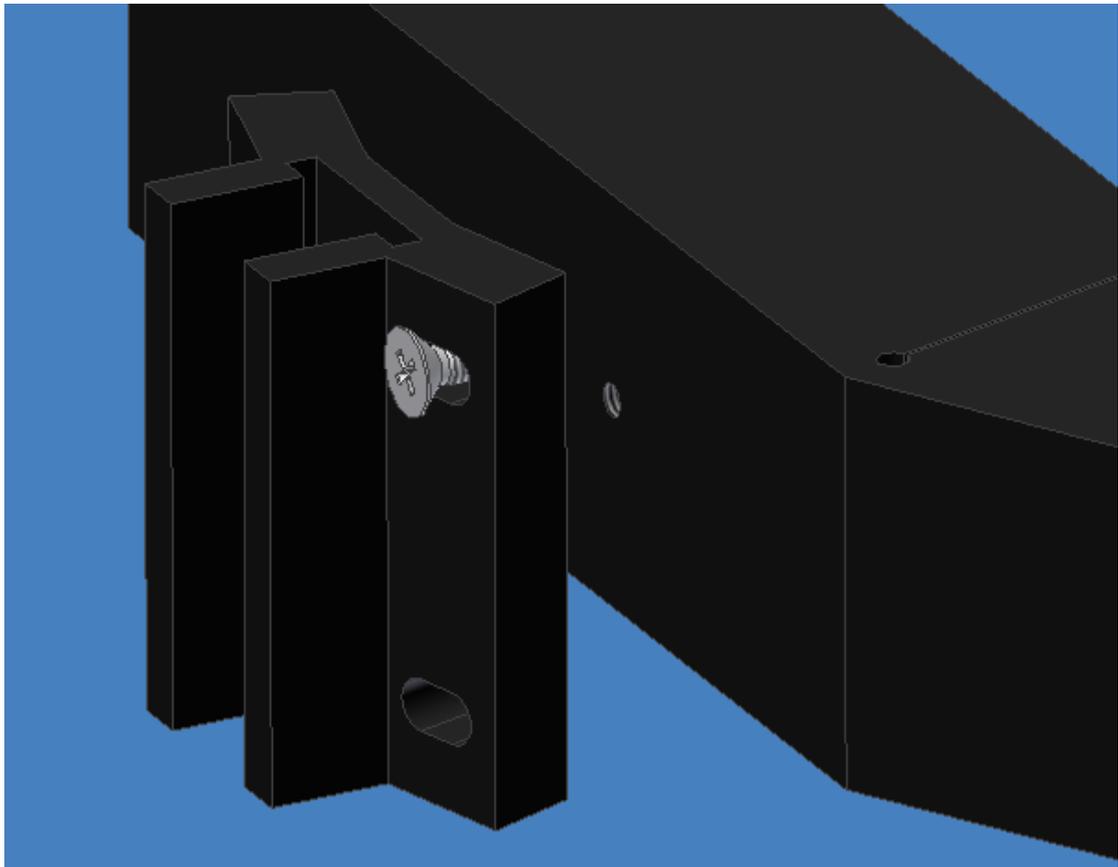
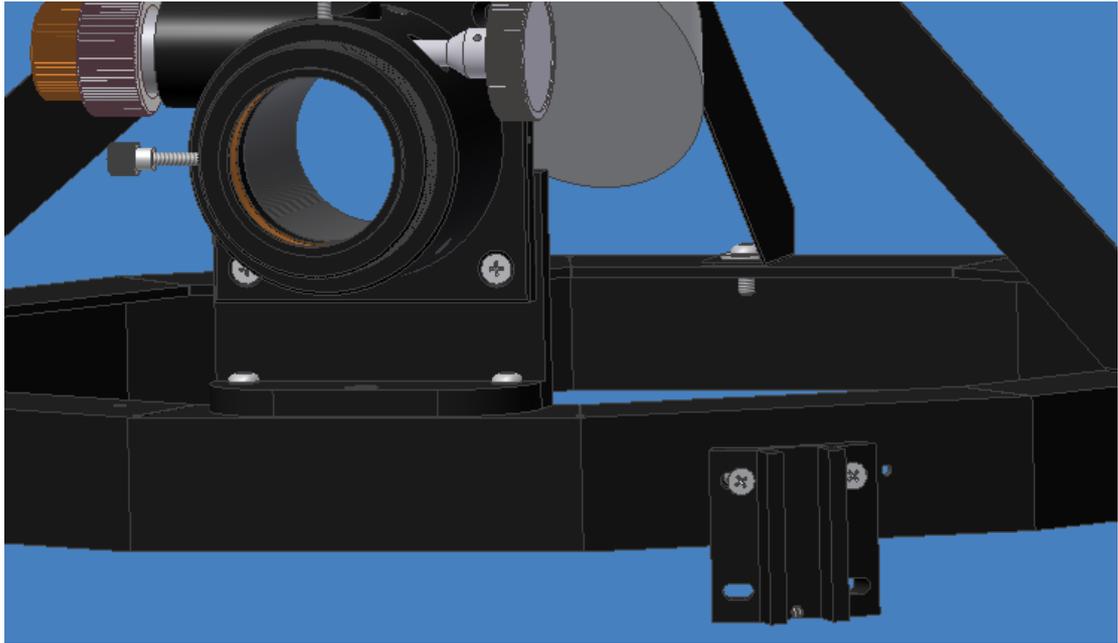
**Figure 20:Then slide in one adjacent slot**



**Figure 21:Then slide in other two slots at the same time**

### 2.4.3 Installation of the Optional Finder Scope

Use 2 provided (hexagon or cross) socket sunk head screws to mount the finder scope using two of the four finder mounting holes.



## 2.5 Adjust the Sling

After UL14 is fully assembled, the sling must be adjusted.

The primary mirror must be supported in the sling and not by the side pins. Point UL14 about 15° above the horizon, an angle from which you can comfortably reach and adjust the collimation screws.

You will need to use two wrenches to adjust the sling. Make sure that the sling is hung through the slot on the left (or right) split bolt. Just wrap one or two turns on this side. To do this, rotate the head of the bolt with one wrench and hold the opposing nut with other wrench. Lock it tight.

Now go to the sling bolt on the other side. Hold the bolt head with one wrench and loosen the opposing nut. Turn the bolt to wrap the sling until the mirror lifts off the two lower pins. Raise the mirror until it almost touches the upper side pin.

Lock the bolt in this position by tightening the lock nuts. Check to make sure that the mirror is indeed suspended on the sling by pushing on the back of the mirror with your fingertips. With UL14 in a nearly horizontal position, you should be able to move the mirror off the floatation cell support bars easily.

If the mirror tilts against one of the side pins, loosen the retaining nuts and rotate that pin away from mirror until there is a few mm gap between the mirror and the pin.

The mirror must be supported by the sling and not by the side pins.

### 3. Collimate the Optics.

Keep the primary mirror covered during step 1. Point the telescope at 45° altitude during the collimation step 1-3.

You need to make sure that UL14's collimation will not shift when it is pointed at different altitudes by tightening all locking nuts and screws properly along the entire optical path:

- Make sure the focuser is tightly locked in its square base
- Make sure the focuser square base is tightly locked onto the focuser L bracket
- Make sure the focuser L bracket is tightly locked onto the upper ring
- Make sure all three spider vanes are tightly locked onto the spider hub and the upper ring
- The three collimation screws for the secondary mirror need to be properly tightened after collimation
- All knob screws for all the truss tubes need to be tightened properly
- The three primary mirror lock screws need to be tightened properly

Two positions have been provided to mount the focuser for the convenience.

**However, for the maximum collimation stability, and in particular for heavy loads, the focuser should be installed directly on the top side of the Truss Tubes.**

**Step 1:** Center the secondary mirror on the axis of the focuser drawtube.

Use a simple collimation cap (or sight tube) for this step. Insert the cap into the focuser, and look through the peephole of the sight tube at the secondary mirror. If you do not have a collimation cap or sight tube, then simply eyeball it from a distance away from the center of drawtube.

The secondary mirror should appear round and exactly centered in the sight tube. If is, then Step 1 is done. If not, either the secondary holder or the focuser (or both) needs adjustment.

You should check and adjust the secondary holder first. If the error is up or down relative to the primary mirror, you can move it forward or away from the primary by adjusting the center bolt that connect the holder to the spider.

If the error is toward either side of the focuser ( $90^\circ$  to the optical axis), then check to find out if the secondary is well centered in the upper ring. If it isn't, adjust the spider's mounting screws until it is. If this checks out fine, then loosen the 3 mounting screws in the focuser bracket, then tilt the focuser as needed and tighten the mounting screws. Two of mounting holes on the bracket are slightly oversized to allow the focuser to be adjusted to a certain degree. You will have to remove the focuser to adjust the L bracket mounting screws. You may have to re-adjust the spider, if it is still not centered.

**Step 2:** Here you adjust the tilt of the secondary mirror to aim the focuser's axis at the center of the primary. First, remove the primary mirror cover.

A laser collimator will be used for this step: just center the laser beam on the primary's center spot by adjusting three secondary mirror collimation screws.

A small error in secondary alignment is usually not a problem. As long as the pointing error is no more than 1 or 2 percent of the main mirror's diameter, it makes no visible difference.

You will need to repeat Step 2 each time you reassemble the UL14.

**Step 3:** In this, the final and most critical step, you need to tilt the main mirror to center its sweet spot (and its optical axis) in the focuser. This procedure should be done at the beginning of each observing session and checked occasionally during the night, since temperature changes or routine handling may cause your telescope's components to shift enough to change collimation.

A laser collimator is used in this step. Just adjust the three primary collimation screws to center the laser's returning beam on the collimator's faceplate.



**Figure 22:**The primary mirror is not yet collimated.



**Figure 23:**The primary mirror is collimated by laser collimator.

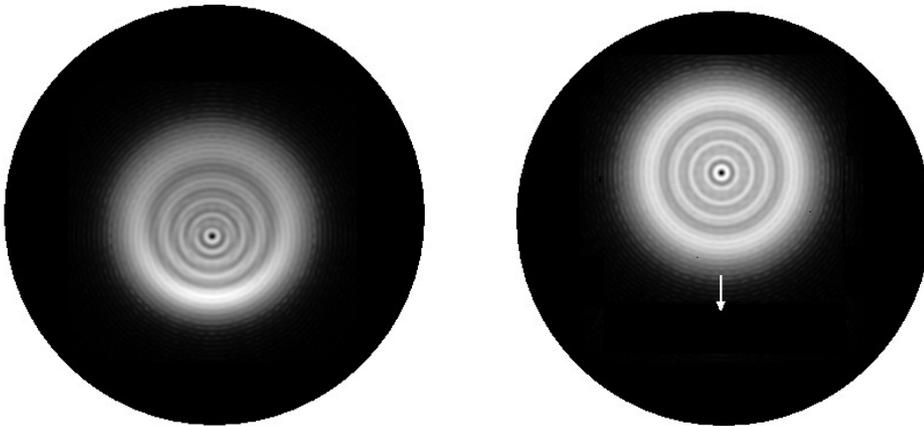
## Step 4: Star-Testing Your Collimation

You should always use an artificial star or a real star to verify the collimation of your scope.

**When collimating UL14 in the horizontal position, you should mount the focuser right on top of the truss tubes! The UL14 is well-engineered to hold its collimation across all positions when the focuser is mounted at this position.**

First you should check if the scope is in rough collimation by observing a strongly defocused star image (move focuser in or out until seeing about 5-10 rings). Start this process with a medium magnification eyepiece, but end with a high magnification eyepiece. Center the star image at the center of the eyepiece. All rings and shadows should be concentric. If not, perform the collimation by adjusting the three primary mirror collimation screws until all rings and shadows are concentric.

If the scope is already in rough but not perfect collimation, you may find the location of the collimated field — the part of the focal plane in your eyepiece where the out-of-focus star is symmetric — and adjust the primary mirror's collimation to bring the collimated field into the center of your eyepiece's field of view. You may repeat it a few times until the scope is in an excellent collimation.



## 4. Care and Maintenance

### 4.1 Mirror Storage

The UL14 should be stored in a clean, dry, dust-free place, safe from rapid changes in temperature and humidity. Do not store the telescope outdoors. Your garage and shed

might be OK, but is not recommended. We highly recommended storing the secondary cage and the mirror box in our optional waterproof Nylon storage bag. Although big enough, do not store the rocker/ground board with the mirrors in the bag for a long time; the potential evaporation from the lubricating material used by the AZ bearing under high temperature will be harmful to the mirror coating.

## 4.2 Mirror Cleaning

You should not have to clean the mirror often. The best thing you can do to keep your mirror is to prevent it from getting dirty in the first place! A simple air-blow cleaning, using an optical air dust blower is the next best thing you can do.

The following instructions tell how to clean a telescope mirror that is very dirty. Your new mirror should not be cleaned this way in any case.

### You'll need

- **Clean towels**
- **Non-alkaline liquid detergent, such as Draft, Basic H, Safe Suds - NO OTHERS. Skip step 2 if you cannot find the appropriate detergent.**
- **A bottle of distilled or de-ionized water**
- **A package of sterile cotton.**

Remove the primary mirror from the mirror box:

- Loosen the sling by loosening the lock nuts on the right split bolts with two wrenches.
- Carefully loosen the three retaining clips, and rotate all clips away from the mirror to clear the way for the mirror.
- Rotate the eccentric pins around to make as much room as possible for the mirror.

To clean the secondary mirror, you will need to remove it from the telescope and clean it with the diagonal holder. Hold the secondary holder stationary while loosening the center hex screw. You do not need to remove the secondary mirror from its holder when cleaning.

Do not touch the surface of the mirror with your fingers. Lift it carefully by its edge.

### Step 1:

Wash out the sink with detergent thoroughly, rinse it well with plenty of water, and lay a folded clean towel on the bottom. Remove any jewelry from your hands and wrists. Put the mirror (aluminized face up) on the towel, and with the drain open, ply the mirror's surface with a gentle stream of room-temperature water for a few minutes. This will remove most dust and grit safely. Next, rinse the surface with a gentle stream of *distilled* water. Do not let the mirror dry.

### Step 2:

Plug the sink, and fill the sink halfway with room temperature water. Add a few drops of the liquid detergent and let the mirror soak for 5 or 10 minutes.

Then use a cotton ball, starting at one edge, swab the mirror in one direction, applying no pressure beyond the weight of the cotton itself. Grit is less abrasive wet than dry, so do this step under water if you can. Don't let the surface dry.

Turn the cotton over in a backward-rolling motion as you go, so that as soon as a part of it rubs the surface, that part is carried up and away from the glass. Throw out the cotton ball when it has been turned completely. Keep a very small stream of tap water flowing as you swab to rinse away detergent. Do not let the mirror surface dry or water marks will form. Keep the stream of tap water going.

Drain the sink and run room-temperature water over the mirror for a few minute.

### **Step 3:**

Finally, rinse the mirror surface with distilled water. Hold the mirror nearly upright so the water runs off, leaving only small droplets behind. Your final rinse should be with distilled water.

Repeat the process with the small secondary mirror.

## **5. Specifications**

Optical design : Reflector

Optical diameter : 355.6mm

Focal length : 1635mm

Focal ratio : f/4.6

Optics type : Parabolic

Eyepieces: Not included

Optical quality : Diffraction limited++ (Strehl 0.95+ for the Primary, 1/10 lambda or for the secondary mirror)

Finder scope : Not included

Focuser : 2" dual-speed linear bearing Crayford

Secondary mirror obstruction : 70 mm

Secondary mirror obstruction by diameter : 19.7%

Secondary mirror obstruction by area : 3.9%

Mirror coatings/over-coatings : 92% Semi-Enhanced Aluminum coating on the primary and 96% Enhanced coating on the secondary mirror

Materials : Aluminum Alloy (T6063-T6) tube with black stainless steel knob screws, T6061-T6 Main structure, Structure Steel mirror cell

Length of optical tube : 60 in.

Weight, optical tube : 40 lbs.

Weight, fully assembled : 48 lbs.

Additional, optional accessories : 8x50 Finder, Shroud, Wheelbarrow, Vinyl foam Cushioned Grips

Other features : Sling lateral support and deluxe push-pull brass knob collimation screws

## **6. Limited Warranty**

Hubble Optics (Optel Engineering Group Inc.), Seller, warrants to the original purchaser only, that goods sold will be free of material defects in design, materials and workmanship for a period of one year following the date of shipment by Seller to Buyer. Seller will repair or replace, or refund the purchase price as to, goods that do not conform to the foregoing warranty, provided the cause of the nonconformity does not arise from or relate to modification, misuse, or abuse by the customer, and provided a warranty claim, stating in writing and with reasonable particularity the claimed nonconformity, and the goods, are delivered to Seller within the one year period. Repair or replacement of the product or refund of the purchase price, at Seller's sole option, shall be the Buyer's exclusive remedies. Seller shall not be responsible for any indirect, special or consequential damages arising from use of the products. This warranty is given in lieu of any other warranties, express or implied, including of performance, merchantability, fitness for particular purpose, or arising from course of dealing or usage of trade. Goods subject to this warranty must be shipped postage pre-paid by Buyer to the Seller. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

## **7. Technical Support**

Hubble Optics (Optel Engineering Group Inc.) will provide the support for the basic operations outlined in this document by email. You will receive a response, generally within 24 hours.