INSTRUCTION MANUAL

Orion® StarBlast™ Imaging Optical Tube Assembly

#9974

ORION®
TELESCOPES & BINOCULARS
Providing Exceptional Consumer Optical Products Since 1975

Customer Support (800)-676-1343
E-mail: support@telescope.com
Corporate Offices (831)-763-7000
89 Hangar Way, Watsonville, CA 95076

IN 293 Rev. C 02/09

Figure 1. The StarBlast Imaging OTA.

Congratulations on your purchase of an Orion StarBlast Imaging optical tube assembly (OTA). Your StarBlast Imaging OTA is a Newtonian reflector telescope with high quality optics and excellent mechanical construction. It has been specially optimized for use with astronomical CCD imaging cameras that utilize chips up to 1⁄2" in size. These instructions will help you set up and use your telescope.

Getting Started

The StarBlast Imaging OTA comes nearly fully assembled from the factory. The telescope's optics have been installed and collimated, so you should not have to make any adjustments to them.

Please keep the original shipping box! In the unlikely event you should need to ship the telescope back to Orion for warranty repair service, you should use the original packaging. The box also makes a very good container for storing the telescope when it is not in use.

Attaching the StarBlast Imaging OTA to a Mount

The StarBlast Imaging OTA can be attached to a mount by the use of optional tube rings. Tube rings with an inner diameter of 140mm (5.5"), such as Orion item #7373, are needed. First attach the tube rings to your telescope mount, then place the optical tube in the tube rings.

Use of Optional Finder Scope and Eyepieces

The StarBlast Imaging OTA does not come with a finder scope or eyepieces in order to grant the user the greatest versatility in customizing the instrument to suit their tastes. However, certain rules for using accessories still apply.

To use any Orion finder scope that has a dovetail bracket, an optional dovetail holder (Orion #7214) is required (Figure 2). To attach the dovetail holder to the tube, first remove the thumbnuts from the screws located near the focuser (Figure 1). Then, remove the screws themselves by unthreading the exposed hex nuts. Keep the tube in a horizontal position when doing this in order to prevent the screws from falling inside the telescope and onto the primary mirror. Now, use the hex nuts and screws that come with the dovetail holder to attach the holder to the tube. The dovetail holder should be oriented so the notch (Figure 2) is facing the rear (primary mirror cell) of the telescope.

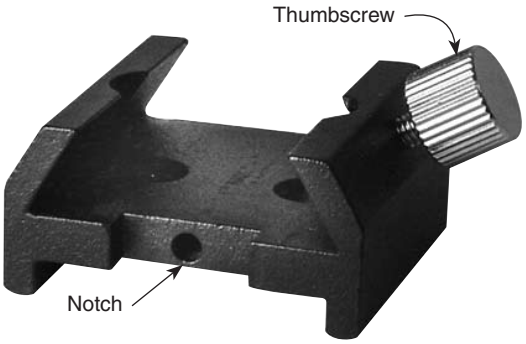

Figure 2. To attach an Orion finder scope, an optional dovetail holder is required.

To connect the finder scope, simply unthread the thumbscrew on the dovetail holder, and insert the base of the finder scope bracket. Retighten the thumbscrew to secure the finder scope and bracket in place. Finder scopes that do not use a dovetail bracket will need to be attached by some other means.

The StarBlast Imaging OTA can use almost any 1.25" eyepiece. Insert the eyepiece into the focuser and secure it with the thumbscrews on the focuser's drawtube. Focus the eyepiece by rotating the focus knob.

Calculating Magnification (Power)

It is desirable to have a range of eyepieces of different focal lengths to allow viewing over a range of magnifications. To calculate the magnification, or power, of a telescope, simply divide the focal length of the telescope by the focal length of the eyepiece:

$$\frac{\text{Telescope Focal Length (mm)}}{\text{Eyepiece Focal Length (mm)}} = \text{Magnification}$$

For example, the StarBlast Imaging OTA, which has a focal length of 450mm, used in combination with a 25mm eyepiece, yields a magnification of

$$\frac{450\text{ mm}}{25\text{ mm}} = 18\text{x}$$

Every telescope has a useful limit of power of about 45x-60x per inch of aperture. Claims of higher power by some telescope manufacturers are a misleading advertising gimmick and should be dismissed. Keep in mind that at higher powers, an image will always be dimmer and less sharp (this is a fundamental law of optics). The steadiness of the air (the "seeing") will usually limit how much magnification an image can tolerate.

Always start viewing with your lowest-power (longest focal length) eyepiece in the telescope. After you have located and observed the object with it, you can try switching to a higher-power eyepiece to ferret out more detail, if atmospheric conditions permit. If the image you see is not crisp and steady, reduce the magnification by switching to a longer-focal-length eyepiece. As a general rule, a small but well-resolved image will show more detail and provide a more enjoyable view than a dim and fuzzy, over-magnified image.

Astroimaging with the StarBlast Imaging OTA

Because of its "fast" F/4 optics, the StarBlast is a great telescope for wide-field astroimaging. This version of the StarBlast telescope has been optimized specifically for use with astronomical CCD imaging cameras, like the Orion StarShoot cameras. Unlike most telescopes, it provides full illumination across the entire field of view of a CCD chip up to 1⁄2" in size. The focal plane position has also been optimized so CCD cameras will reach focus without any user modification to the tube required.

To use your CCD camera with the StarBlast, it must have a 1.25 inch "nosepiece". All Orion StarShoot cameras have this nosepiece (Figure 3). Due to the large amount of inward focus travel required, however, digital SLRs equipped with a 1.25" nosepiece (via T-ring connection) will not reach focus in the StarBlast Imaging OTA.

First, acquire and center the object to be imaged with an eyepiece. Then, remove the eyepiece and insert your CCD camera into the telescope's focuser. Secure the camera with the thumbscrews on the focuser's drawtube. Use the focus knob to bring the image into focus.

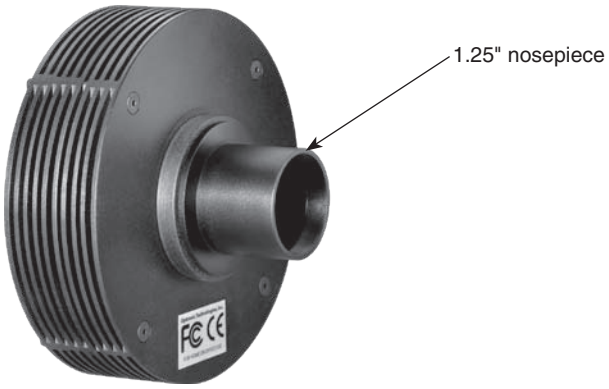

Figure 3. To use a CCD camera with the StarBlast, the camera must have a 1.25" nosepiece, like the Orion StarShoot Imaging cameras.

Collimating the Optics

Collimating is the process of adjusting the mirrors so they are aligned with one another. Your telescope's optics were aligned at the factory, and should not need much adjustment unless the telescope is handled roughly. Accurate mirror alignment is important to ensure peak performance of your telescope, so it should be checked regularly. Collimating is relatively easy to do and can be done in daylight.

To check optical alignment, remove the eyepiece and look down the focuser drawtube. You should see the secondary mirror centered in the drawtube, as well as the reflection of the primary mirror centered in the secondary mirror, and the reflection of the secondary mirror (and your eye) centered in the reflection of the primary mirror, as in Figure 4a. If anything is off-center, proceed with the following collimating procedure.

The Collimating Cap and Primary Mirror Center Mark

Your StarBlast comes with a collimating cap. This is a simple cap that fits on the focuser drawtube like a dust cap, but has a hole in the center and a silver bottom. This helps center your eye so collimating is easy to perform. Figures 4b through 4e assume you have the collimating cap in place.

In addition to the collimating cap, you'll notice a small ring label on the exact center of the primary mirror. This "center mark" allows you to achieve a very precise alignment of the primary mirror; you don't have to guess where the center of the mirror is. You simply adjust the primary mirror position (described below) until the reflection of the hole in the collimating cap is centered inside the ring.

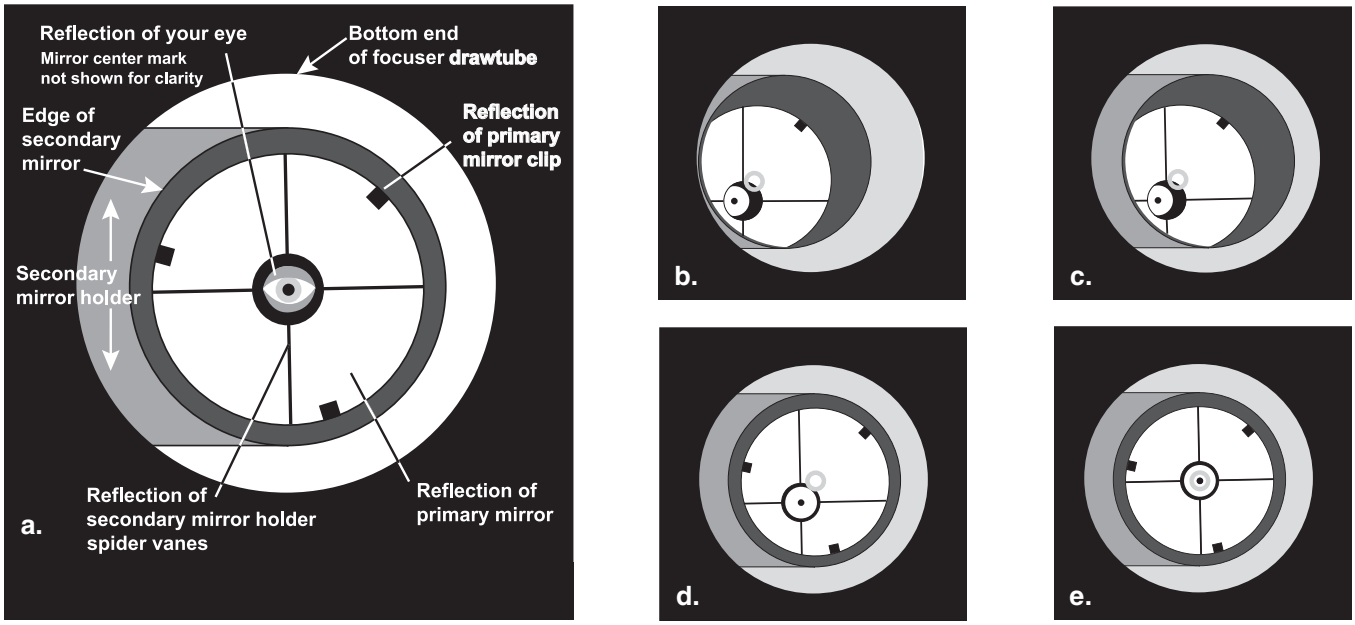

Figure 4. Collimating the optics. **(a)** When the mirrors are properly aligned, the view down the focuser drawtube should look like this. **(b)** With the collimation cap in place, if the optics are out of alignment, the view might look something like this. **(c)** Here, the secondary mirror is centered under the focuser, but it needs to be adjusted (tilted) so that the entire primary mirror is visible. **(d)** The secondary mirror is correctly aligned, but the primary mirror still needs adjustment. When the primary mirror is correctly aligned, the "dot" will be centered, as in **(e)**.

Note: The center ring sticker need not ever be removed from the primary mirror. Because it lies directly in the shadow of the secondary mirror, its presence in no way adversely affects the optical performance of the telescope or the image quality. That might seem counter-intuitive, but it's true!

Aligning the Secondary Mirror

It helps to adjust the secondary mirror in a brightly lit room with the telescope pointed toward a bright surface, such as white paper or wall. Placing a piece of white paper in the telescope tube opposite the focuser (i.e. behind the secondary mirror) will also be helpful in collimating the secondary mirror.

With the collimating cap in place, look through the hole in the cap at the secondary (diagonal) mirror. Ignore the reflections for the time being. The secondary mirror itself should be centered in the focuser drawtube. If it isn't, as in Figure 4b, it must be adjusted. Typically, this adjustment will rarely, if ever, need to be done.

Note: When make adjustments to the secondary mirror position, be careful not to stress the spider vanes, or they may bend.

To adjust the secondary mirror left-to-right in the focuser drawtube, use a 2.5mm hex key to loosen the three small alignment setscrews in the center hub of the 4-vaned spider several turns. Now hold the mirror holder stationary (be careful not to touch the surface of the mirror), while turning the center screw with a Phillips head screwdriver (Figure 5). Turning the screw clockwise will move the secondary mirror toward the front opening of the optical tube, while turning the screw counterclockwise will move the secondary mirror toward the primary mirror. When the secondary mirror is centered left-to-right in the focuser drawtube, rotate the secondary mirror holder until the reflection of the primary mirror is as centered in the secondary mirror as possible. It may not be perfectly centered, but that is OK for now. Tighten the three small alignment setscrews equally to secure the secondary mirror in that position.

Figure 5. To center the secondary mirror under the focuser, hold the secondary mirror holder in place with your fingers while adjusting the center screw with the Phillips head screwdriver. Do not touch the mirror's surface.

To adjust the secondary mirror up-and-down in the focuser drawtube, adjust the length of the two spider vanes perpendicular to the focuser. This is done by tightening the knurled thumbnuts that secure the vanes to the tube (Figure 6). Loosen one thumbnut, then tighten the other until the secondary mirror is centered in the drawtube.

Figure 6. To center the secondary mirror up-and-down in the focuser drawtube, make adjustments to the two knurled spider vane thumbnuts that are perpendicular to the focuser.

The secondary mirror should now be centered in the focuser drawtube. Now we will shift our attention to the reflections within the secondary mirror.

If the entire primary mirror reflection is not visible in the secondary mirror, as in Figure 4c, you will need to adjust the tilt of the secondary mirror. This is done by alternately loosening one of the three alignment setscrews while tightening the other two, as depicted in Figure 7. You will need a 2mm hex key to do this. The goal is to center the primary mirror reflection in the secondary mirror, as in Figure 4d. Don't worry that the reflection of the secondary mirror within the primary mirror reflection (the smallest circle, with the collimation cap "dot" in the center) is off-center. You will fix that in the next step.

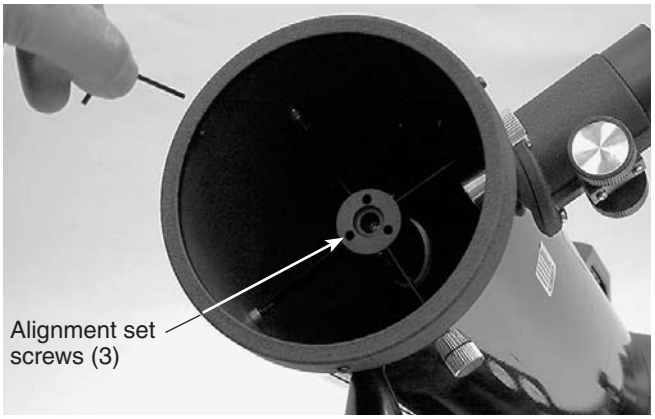

Figure 7. Adjust the tilt of the secondary mirror by loosening one of the three alignment set screws then tightening the other two.

Once the secondary mirror is centered in the focuser drawtube, and the primary mirror reflection is centered in the secondary mirror, the secondary mirror is properly aligned, and no further adjustments to it should be needed.

Aligning the Primary Mirror

The final adjustment is made to the primary mirror. It will need adjustment if, as in Figure 4d, the secondary mirror is centered in the focuser drawtube and the reflection of the primary mirror is centered in the secondary mirror, but the small reflection of the secondary mirror (with the "dot" of the collimating cap) is off-center.

The tilt of the primary mirror is adjusted with the three large knurled thumbscrews on the rear end of the optical tube (back of the mirror cell) (Figure 8). The small thumbscrews (with slots in them) serve to lock the mirror in place. Start by loosening each of these smaller thumbscrews a few turns. Use a screwdriver in the slots, if necessary. Now adjust the tilt of the primary mirror by turning one of the large thumbscrews either clockwise or counterclockwise. Look into the focuser and see if the secondary mirror reflection has moved closer to the center of the primary mirror reflection. You can determine this easily with the collimating cap and primary mirror center mark by simply watching to see if the "dot" of the collimating cap is moving closer or farther away from the "ring" on the primary mirror. If it isn't getting closer, try turning the thumbscrew in the opposite direction. Repeat this process for the other two large thumbscrews, if necessary. It will take a little trial-and-error to get the feel for how to adjust the primary mirror to center the dot of the collimating cap in the ring of the primary mirror center mark.

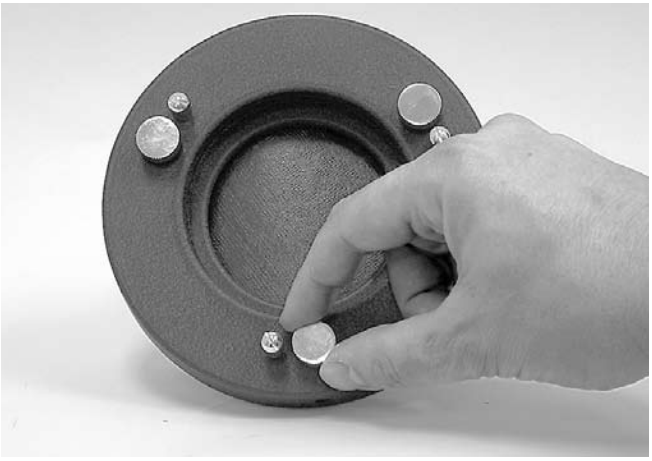

Figure 8. The tilt of the primary mirror is adjusted by turning the three larger thumbscrews.

When you have the dot centered as much as possible in the ring, your primary mirror is aligned. The view through the collimating cap should resemble Figure 4e. Make sure the smaller thumbscrews on the back of the mirror cell are tightened to lock the primary mirror in position.

A simple star test will tell you whether the optics are, in fact, accurately aligned.

Star-Testing the Telescope

When it is dark, point the telescope at a bright star and accurately center it in the eyepiece's field of view. Slowly de-focus the image with the focus knob. If the telescope's optics are correctly aligned, the expanding disk should be a perfect circle (Figure 9). If the image is unsymmetrical, the optics are out of alignment. The dark shadow cast by the secondary mirror should appear in the very center of the out-of-focus circle, like the hole in a donut. If the "hole" appears off-center, the optics are out of alignment.

If you try the star test and the bright star you have selected is not accurately centered in the eyepiece, the telescope will appear to need optical alignment, even though the optics may be perfectly collimated. It is critical to keep the star centered, so over time you will need to make slight corrections to the telescope's position in order to account for the sky's apparent motion.

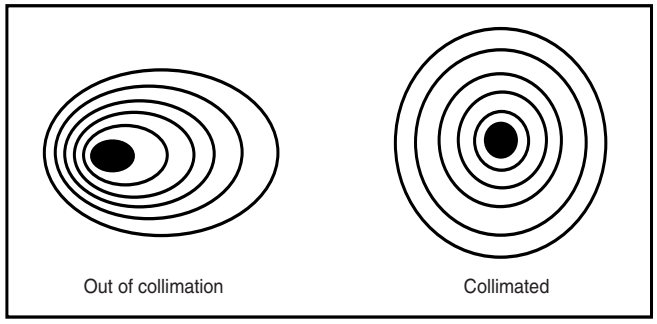

Figure 9. A star test will determine if the telescope's optics are properly collimated. A defocused view of a bright star through the eyepiece should appear as illustrated on the right if optics are perfectly collimated. If the circle is unsymmetrical, as illustrated on the left, the scope needs alignment.

Care & Maintenance

If you give your telescope reasonable care, it will last a lifetime. Store it in a clean, dry, dust-free place, safe from rapid changes in temperature and humidity. Do not store the telescope outdoors, although storage in a garage or shed is OK. Small components like eyepieces and other accessories should be kept in a protective box or storage case. Keep the dust cover on the front of the telescope and the dust cap on the focuser drawtube when it is not in use.

Your StarBlast requires very little mechanical maintenance. The optical tube has a smooth painted finish that is fairly scratch-resistant. If a scratch does appear on the tube, it will not harm the telescope. If you wish, you may apply some auto touch-up paint to the scratch. Smudges on the tube can be wiped off with a soft cloth and household cleaning fluid.

Cleaning Mirrors

You should not have to clean the telescope's mirrors very often; normally once every year or so is fine. Covering the front opening of the telescope with the dust cover when it is not in use will prevent dust from accumulating on the mirrors. Keeping the dust cap on the focuser's 1.25" opening is also a good idea. Improper cleaning can scratch the mirror coatings, so the fewer times you have to clean the mirrors, the better. Small specks of dust or flecks of paint have virtually no effect on the visual performance of the telescope.

The large primary mirror and the elliptical secondary mirror of your telescope are front-surface aluminized and over-coated with hard silicon dioxide, which prevents the aluminum from oxidizing. These coatings normally last through many years of use before requiring re-coating.

To clean the secondary mirror, first remove it from the telescope. Do this by keeping the secondary mirror holder stationary while completely unthreading the Phillips-head screw in the center hub of the spider vane assembly (see Figure 5). Do not touch the mirror surface when doing this. Be careful, there is a spring between the secondary mirror holder and the Phillips head screw; be sure it does not fall into the optical tube and onto the primary mirror. Once the Phillips-head screw is unthreaded, the secondary mirror and its holder can be removed from the telescope. Then follow the same procedure described below for cleaning the primary mirror. The secondary mirror does not need to be removed from its holder for cleaning.

To clean the primary mirror, first carefully remove the mirror cell from the telescope. For the StarBlast, you must completely unthread the three screws on the exterior perimeter of the mirror cell (Figure 10). Then pull the cell away from the tube. You will notice the primary mirror is held in the mirror cell with three clips held by two screws each. Loosen the screws and remove the clips.

Figure 10. To remove the mirror cell from the telescope, the three small Phillips-head screws on the perimeter of the mirror cell must be completely unthreaded.

You may now remove the primary mirror from its cell. Do not touch the surface of the mirror with your fingers. Lift the mirror carefully by the edges. Set the mirror on a clean soft towel. Fill a clean sink free with room temperature water, a few drops of liquid dishwashing detergent, and if possible, a capfull of 100% isopropyl alcohol. Submerge the mirror (aluminized face up) in the water and let it soak for a few minutes (or hours if it's a very dirty mirror). Wipe the mirror under water with clean cotton balls, using extremely light pressure and stroking in straight lines across the mirror surface. Use one ball for each wipe across the mirror. Then rinse the mirror under a stream of lukewarm water. Any particles on the surface can be swabbed gently with a series of cotton balls, each used just one time. Dry the mirror surface with a stream of air (a "blower bulb" works great). Cover the mirror surface with tissue, and leave the mirror in a warm area until it is completely dry before replacing it in the mirror cell and telescope.

Specifications

Optical tube:	Steel
Primary mirror:	Parabolic, center marked
Aperture:	4.5" (114mm)
Effective focal length:	450mm
Focal ratio:	f/3.9
Minor axis of secondary mirror:	1.85" (47.0mm)
Mirror coatings:	Aluminum with silocon dioxide (SiO_2) overcoat
Focuser:	Rack-and-pinion, accepts 1.25" eyepieces
Weight:	3.7 lbs.
Length:	17.25"

One-Year Limited Warranty

This Orion StarBlast Imaging OTA is warranted against defects in materials or workmanship for a period of one year from the date of purchase. This warranty is for the benefit of the original retail purchaser only. During this warranty period Orion Telescopes & Binoculars will repair or replace, at Orion's option, any warranted instrument that proves to be defective, provided it is returned postage paid to: Orion Warranty Repair, 89 Hangar Way, Watsonville, CA 95076. If the product is not registered, proof of purchase (such as a copy of the original invoice) is required.

This warranty does not apply if, in Orion's judgment, the instrument has been abused, mishandled, or modified, nor does it apply to normal wear and tear. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. For further warranty service information, contact: Customer Service Department, Orion Telescopes & Binoculars, 89 Hangar Way, Watsonville CA 95076; (800)-676-1343.

Orion Telescopes & Binoculars

89 Hangar Way, Watsonville, CA 95076

Customer Support Help Line (800)-676-1343 • Day or Evening