

DOWN HOME astronomy from
Chaos Manor South!

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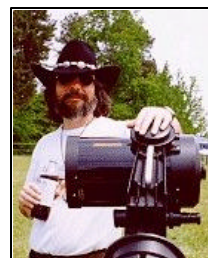
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Rod Mollise's

Skywatch



Brainless Astronomy With...

Servocat

Jack Huerkamp

Brainless astronomy – what's that, you may ask? Well, that's a term that was introduced to me by **Beth Watzke**, a member of the Pontchartrain Astronomy Society and a schoolteacher. She uses that phrase to describe astronomers that use goto systems to aim their scopes without the need to know anything about the sky. Her husband, John had a Meade LX90 and has graduated to a Meade LX200GPS – both goto telescopes. He practices "brainless astronomy". She on the other hand likes to learn the sky by star hopping with her Orion 10" Dob.

For over 20 years, I observed like Beth with my 17.5" Dobsonian reflector to find objects. My original Dob wasn't fancy; but it gave excellent views of deep sky objects. It wasn't computerized and it didn't possess setting circles. To locate deep sky objects, I had to pull out my star charts, climb the ladder to the eyepiece, and, with a red light shinning on the map, follow a trail of stars to my target. On many occasions, I gave up in frustration – my hunt was not successful. This wasted valuable observing time in an area of the country where good nights are rare.



TSP'82 with Original Dob

In 1997, I updated my 17.5" scope. Well, actually, I saved only the primary mirror and burned the rest on my trash pile. I ordered an AstroSystems TeleKit to house the mirror, and spent 39 months finishing it. When the scope was completed, I decided to embark on a new way to observe. I added 8192 step encoders on the altitude and azimuth axes, and an Argo Navis DSC (digital setting circle) computer.



Argo Navis

The Argo Navis provided the brain, letting me know how far the scope was from the desired target. By simply pushing the scope in altitude and azimuth to zero-out the offset

positions determined by the "black box," I was able to locate targets. However, this was not a *true* goto system – it was "push-to."

While at the 2003 Mid-South Stargaze, I ran into Jim Nadeau. He was delivering a new 18" NightSky Scope to Elliott McKinley. Elliott had ordered all the bells and whistles from Jim, including a ServoCAT. I was able to see Elliott's scope in action at the event, and decided to make the final jump to *brainless astronomy* with my 17.5" TeleKit.



18" NightSky Scope with ServoCAT

What's a ServoCAT?

The ServoCAT system is a complete electronics package that allows for control of a telescope using either an Argo Navis DSC or the similar Sky Commander as the "reference." A ServoCAT can be used to control either a Dobsonian or an equatorially mounted telescope. "Control" means the ability to track or automatically follow the sky, slew (move around) at various speeds selectable by the user, and "Go To" an object.



ServoCAT-Sky Controller

The "standalone" version of the system is called the ServoCAT-Sky. Those desiring to use a computer in lieu of an Argo Navis or Sky Commander need to purchase the ServoCAT-BB. The ServoCAT-Sky is the unit I purchased, since I already owned an Argo Navis. The Sky version allows users to connect their Argo Navis DSC or Sky Commander to the ServoCAT system without the need for a PC. It provides for tracking and FULL goto operation using the DSC computer as the object database! All features of the DSC remain useable, including object ID and Search as well as Constellation search!



ServoCAT Handpad

The system includes a full-featured wired handpad; and an optional (2nd) WIRELESS handpad is available! Handpad SLEW (5 to 6 degrees per second), goto as well as other functions provide for great control and full use of the telescope. Although a PC is *not* needed at the telescope, the setup of parameters is through a simple Windows utility. It is performed once and the information is stored in the controller. More than one scope can be programmed into the software, so the controller can easily be transferred to another ServoCAT motorized scope if desired. High power viewing is practical because the CAT automatically tracks the target once it is located!

The ServoCAT-Sky version uses the DSC encoders mounted on the scope's two axes as an "absolute" reference. Therefore manually

movement or slip (intentional or not) of the scope will not affect proper tracking rates and goto capability. A realignment is not required if the scope is manually moved as long as the ground board does not change position.

Full kits are available for TeleKits, Obsessions, and Obsession clones. The kit includes:

- The Controller Unit
- 8 Button Wired Handpad
- Two Deluxe Servo Gearboxes
- All Mounting Hardware
- All Cables and Wiring
- Full Instructions

Optional items include:

- Round Groundboard
- Powered Groundboard
- Wireless Handpad

The current price for a kit for a 15"-20" scope is \$1599. The kit for a 21"-30" scope is \$1699. The CATpaw Wireless Handpad is \$219 and the Argo Navis is \$399. There is also a ServoCAT Jr. for 8" through 14" scopes for \$1369.

For more information on the ServoCAT, contact Gary Myers at:

www.stellarcat.biz

ServoCAT Installation

Within a week of the 2003 Mid-South Stargaze, I contacted Gary Myers of StellarCAT (formerly RXDesign) and ordered a system. Gary was anxious to get a CAT installed on a TeleKit, and since I was his guinea pig, he gave me a slight discount off of the then list price of \$1499. The delivery time for the CAT was about 4-6 weeks, and while I waited for its arrival, I downloaded the information available on the RXDesign website.

This quickly revealed the first obstacle that I needed to overcome.



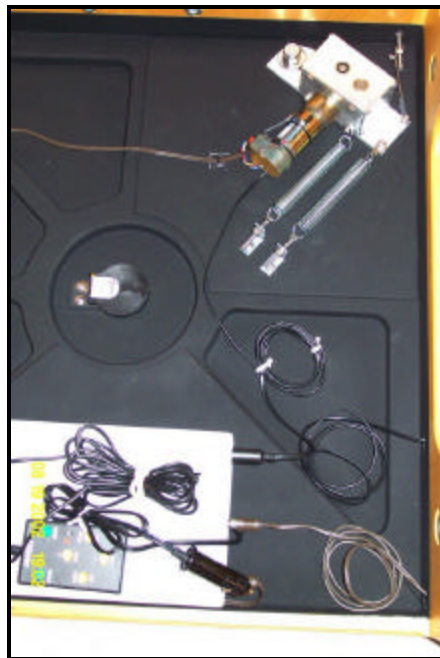
Rocker Base with Two Plugs

Newer TeleKits have an advantage over older ones regarding adding the azimuth drive to the rocker. My scope had the original, double-thickness rocker base with pockets cut into it to reduce weight while retaining strength. As the azimuth drive requires a smooth, flat mounting surface, I needed to devise a means to fill in some of the "holes" in the rocker. I prepared a full-scale AutoCAD drawing of the inside of the rocker bottom showing all the pockets. From it, I made a template and cut out two plugs from pieces of Home Depot $\frac{3}{4}$ " Birch plywood. The plugs were then covered with a section of $\frac{1}{8}$ " model aircraft plywood to provide a solid, smooth base for the azimuth drive.



Plugs Covered With Plywood

The necessary holes for the azimuth drive wheel and manual release clamp were drilled into the rocker, and the azimuth drive bolted into place.



Azimuth Drive Assembly

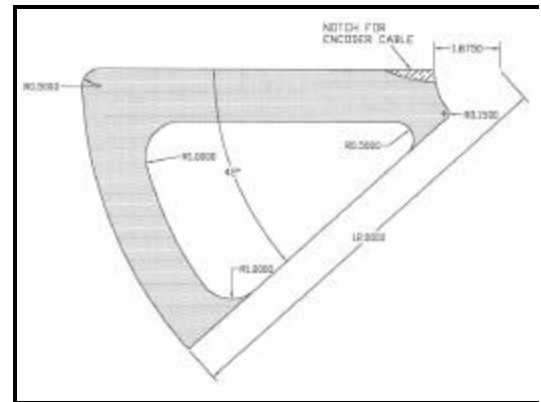
The two springs provide the necessary tension to hold the drive wheel against the edge of the round groundboard.



Groundboard and Azimuth Drive Wheel

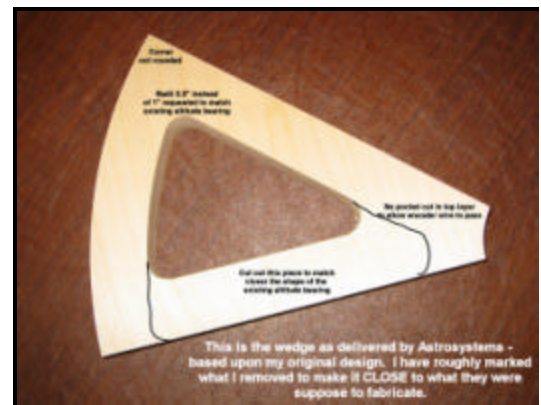
With the azimuth drive installed, attention turned to the altitude assembly. A new problem surfaced. Most Dobs have their altitude bearings separated by 60-70 degrees; but those on the TeleKit were separated by 90 degrees. With the scope aimed at either the zenith or at the horizon, there was no altitude bearing projecting above the Teflon pads. This is critical, as the drive cable must contact the altitude bearing as it leaves the drive wheel. I had to devise a solution. I drew a side view of the rocker and mirror box using

AutoCAD, and developed a "wedge" to lengthen the altitude bearing.



Altitude Wedge

I sent the file to Randy at AstroSystems, and within three weeks I had the prototype in hand. It wasn't made exactly like the drawing,



Wedge As Delivered by AstroSystems

but I was able to modify it to be close to what I had specified. I cut out the portion of the wedge that I didn't want and rounded over all edges. I then sealed and varnished the wedge and screwed it onto the mirror box. The rest of the altitude cable drive installation went according to the instructions.



Finished Wedge Installed on Mirror Box

I had previously made a laptop table that mounted to the rocker using the wheelbarrow handle T-nuts. However, now that the altitude drive had been installed, I needed to modify the leg on my laptop table. The altitude drive motor was right in the way. I fabricated a box out of 3/4 Birch plywood to encompass the drive and removed a piece of the leg to make a place for it. It helped keep the aesthetics of the TeleKit.



Altitude Motor Drive Cover

With all problems solved, I was now ready for my first class in "brainless astronomy."



TeleKit with ServoCAT, Laptop Table and Tag-Along Battery Supply

Due to the long stretch of bad weather that plagued the gulf south for most of the summer of 2003, I was not able to test the ServoCAT until Monday, September 15th. The wait was worth it! I set up the scope before dark, and by 8:00 PM, I was able to align the Argo Navis on Vega and Altair. For the next 90 minutes, the ServoCAT guided the scope to over 30 objects (one every 3 minutes), and all targets fell within the center of the 100X field of view of my 20mm eyepiece. Once the targets were found, the ServoCAT followed them. I tested the tracking on The Blue Snowball for 10 minutes at 300X – the ServoCAT passed the test. Prior to the 'CAT, observing at high powers was a problem. Constant re-adjustment of the scope to allow the object to track across the field of view did not allow for intense scrutiny of the target. This also presented a problem at stargazes. I would have to constantly climb the ladder to place the object in the field for the next observer. Now with tracking, subtle detail that could not be detected without tracking is now seen.

If you have any questions on my TeleKit, the ServoCAT, or my laptop table, you can contact me at: jhuerkamp@bellsouth.net

Additional information on the construction of my TeleKit and the modifications I have made to it may be seen on my website:

<<http://www.WaningMoonII.com>>

PS: I recently added a MallinCam Video CCD Observational System to my telescope setup. A separate article on this amazing device follows in this issue of Skywatch.

MallinCamTM Video CCD Observational System

Jack Huerkamp

My interest in Video Astronomy began when I encountered an article entitled "Deep-Sky Imaging with Integrating Video Cameras" in the December 2003 issue of Sky & Telescope. I read and re-read this article; and the comments about "seeing up to *three magnitudes fainter* than those objects visible through a conventional eyepiece through the same instrument" really caught my attention. I checked out the websites for the vendors listed and I joined the videoastro Yahoo E-Group. I monitored the messages to it and was amazed by the images posted.

In early May of 2004, two of my fellow Pontchartrain Astronomy Society club members, Walter Sarraat and Steve Sholar, invited me over to their observatory to see a video CCD integrating camera in action. I also brought along my vintage orange C-8 and f/6.3 focal reducer to do some observing as the skies at their location are fairly dark for southeast Louisiana. Steve had his camera installed in a Short Tube 80 that was riding piggy-back on his 6" Celestron refractor. The camera's output was directed to a 13" TV/VCR. The views were simply amazing. There was more detail seen in Comet C/2001 Q4 NEAT using the ST80 and camera than I could visually see through my C-8. I quickly packed up my scope and spent the rest of the night looking at the TV's screen. My wife, Jacqueline, stated that through the use of the camera, she could finally see detail in celestial objects – detail that she could not see when looking through an eyepiece. After that one

session with a video CCD integrating camera, I knew I would purchase one. But, which one should I buy?

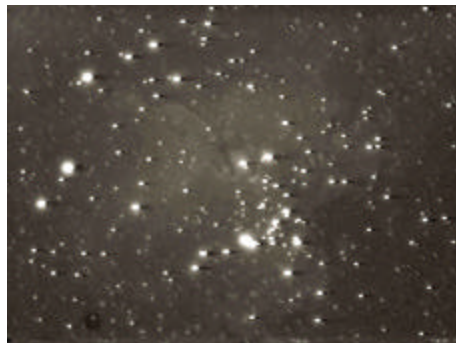
Between May and July, I continued to monitor the conversations on videoastro. One day I saw a reference to the MallinCam™; and I contacted Rock Mallin of Pro Com Electronics of Ottawa, Ontario, Canada. I asked him why I should consider his line of cameras instead of the one my friend had. He provided detailed information on the benefits of his products and a list of customers that he recommended I contact. I did so, and after corresponding with them, I decided that the MallinCam™ was the camera for me.

However, I could not decide if I wanted to get the MallinCam™ PRO (B&W) or the MallinCam™ II Color. To simplify the process, I ordered one of each in early July, and I received them on September 3rd.

On Sunday, September 5th, I had the first chance to observe with the MallinCam™ PRO. I used my 6" Celestron refractor and focal reducer to change the system to f/5. I removed the PRO from its case, placed it into the focuser, hooked up the power and video cables, attached the video cable to my 13" TV/VCR and focused the scope on M17, the Swan Nebula. Nebulosity filled the screen of the TV.



I moved the scope to M16, and watched the monitor as the Eagle soared into view.



Even with my 17.5" TeleKit under dark skies, the Eagle has proven to be an elusive target. But in my magnitude 5 backyard, I was seeing it live with a 6" telescope!

The last target for the night was NGC 7331. Not only did this galaxy show spiral structure, there were several other galaxies visible on the monitor – including PGC 2051985 at magnitude 16.8. I kept trying to remind myself of the size of the scope I was using.

I didn't get a chance to test the Color unit until Sunday, September 19th. On that morning, I had my 8" f/4 Newtonian set up on my Byers 812 mount and pier to my new observatory (the slab is finished – all that remains are the walls, track and roll-off roof!). This is the same mount I used with the 6" refractor.



I placed the camera into the focuser and aimed the scope at M42. The screen on my TV/VCR quickly revealed the Orion Nebula in all its colorful glory. There was nebulosity everywhere in shades of red, pink, purple and blue. The dark obscuring matter that forms the "Fish's Mouth" was three dimensional, standing up over the bright nebula below. The center of the nebula near the Trapezium was aglow – with the stars totally overexposed. M43's "Shrimp" shape was clearly resolved with the center being pink and the outer edge's being bluish-purple. I spent the next



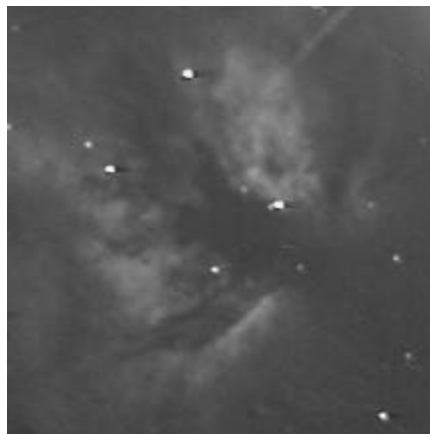
hour looking at the screen while moving the scope around to reveal detail in other areas of M42/M43. The 2.1 second maximum cycle time for a new image made it easy to do so. The image of M42/M43 below is a single frame from the VHS recording, with a single dark frame subtracted. No other image processing was performed.



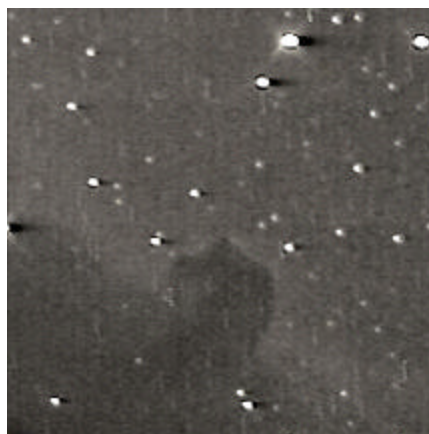
At about 4:30 AM, I decided to swap cameras and see what the more sensitive MallinCam™ PRO would show in the Orion Nebula. A B&W image is shown for comparison.



The photo above is a single frame from the video. The nebulosity is more prominent in the B&W image due to the increased sensitivity of the camera. Also, there is much greater detail in M43 and the dark lane that separates it from the nebulosity below. To close out the evening, I decided to look for the Horsehead. I centered the scope on Zeta Orionis and drifted to the Flame Nebula.



From it, I slid past NGC 2023, a diffuse nebula near the Horsehead. As I moved the scope in the direction of my target, I started to see the dark silhouette of the Horsehead drift into the field of view.



Images of the Flame and Horsehead are included showing their relative brightness. Each is a stack of about 10 frames from the video with no dark frame subtraction. The Flame was much more obvious on the monitor; however the Horsehead was definitely seen live. By the way, just after taking the video of the Horsehead, I decided to look at the primary and secondary mirrors – they were covered with condensation. I can only imagine what the Flame and Horsehead would have looked like with dew-free mirrors! My initial tests with both MallinCam™ cameras were successful.

System Components

The MallinCam™ Video CCD Observational System is manufactured by Rock Mallin, and it is designed specifically for astronomical observing. The video board has been custom designed by him to eliminate the need for the long exposure times of 8.5 seconds found in other cameras currently on the market. He has reproduced the competition's performance using only a 2.1 second integration time. This is very beneficial for users of Dobsonian and other Alt-Az mounted scopes.

MallinCam™ cameras are adjustable from 2X to 128X integration, and they can be used visually and for imaging the Sun (with proper filtration), Moon and Planets. Below is a picture taken with the MallinCam™ II Color during the October 27th lunar eclipse.



Every camera is hand assembled and tested to the highest applicable standards. All camera components are Grade 1 with no exceptions! The CCD sensors are generally Grade 1, with Grade 2 sensors available on the PRO.

The system includes the following items shown below:

- Combination video/power cable
- Regulated power supply
- Component Male/ BNC Female Adapter
- BNC Male/Component Male Adapter
- Allen Wrench

- Camera with Lens Cap and 1 1/4" Adapter



Video Astronomy

What is Video Astronomy and how does the MallinCam Video CCD Observational System fit in?

Video astronomy replaces the eyepiece in your telescope with a specialized camera. It takes the photons that strike its CCD sensor, electronically amplifies the output of this interaction, stores the information, and dumps the data to a monitor. To engage in this facet of astronomy, all that is needed is a fast telescope, a specialized camera like either of the MallinCams, and a monitor. A "fast" scope is critical – preferable f/5 or faster. In the case of a Schmidt-Cassegrain scope, the use of an f/6.3 focal reducer does not make the scope fast enough. If you have a SCT, invest in a Meade f/3.3 focal reducer/field flattener. This device is made for CCD camera use and changes a normally slow f/10 telescope into a fast f/3.3 unit.

Focal reducers can also be used with refractors and Newtonian reflectors to speed them up and increase the Field of View. There are several on the market, but they generally require considerable in-travel.

Either the mirror needs to be relocated toward the secondary in the case of a Newtonian, or the tube needs to be shortened in the case of a refractor.

Rock Mallin has developed a variable (0.38 – 0.68) focal reducer that slides into the 1 1/4" adapter on the front of his cameras. I have successfully used this focal reducer on my 6" f/8 refractor; however, I need to trim about 1/2" off of the truss tubes on my 17.5" Newtonian to achieve focus with either the II Color or PRO.

Regarding monitors, it is best to use one that has 800+ lines of resolution, as the better the monitor, the better the appearance of the target. On occasion, I have observed at locations without the benefit of 110 volt AC power. In those cases, I have used a portable DVD player to view the output of the MallinCams. Although not as clear as a high resolution monitor, the views were quite nice. A picture of the 7" DVD player I use is shown later in this article.

The purists will say that looking at a monitor to see what your scope is aimed at is no different than getting on the Internet and downloading images. I disagree! Doing the latter does not require the ownership of a telescope, nor traveling to remote locations to

observe. Neither does it involve getting cold in the winter or attacked by mosquitoes in the summer. Finally, it does not afford the companionship of getting together with friends to view the heavens. The ONLY difference is that instead of the photons of light hitting the rods and cones in your eye; they hit the pixels on the CCD sensor where they are processed and sent to the monitor.

The benefits afforded by video astronomy are many:

1. Live viewing of the Sun, Moon, Planets, DSOs, Transits, Occultations, and Eclipses is possible by many observers at the same time.
2. People with vision problems, such as "floaters", or those who wear glasses are able to see detail not visible to them in an eyepiece.
3. People with physical handicaps that make standing or climbing ladders impossible are able to participate in the hobby.
4. The effective size of one's telescope is increased dramatically through the use of the specialized camera.

You may ask how is it possible to increase the size of your telescope without trading up to a new one. The answer is simple – the use of very sensitive, low Lux CCD chips, combined with the high Signal-to-Noise of the video processing circuitry, and the ability to accumulate up to 2.1 seconds of video results in you being able to see many magnitudes fainter than you can see visually.

As an example of this phenomenon, I offer the following. On the night of September 18th, the evening before I took the above images of the Orion Nebula, I had several members of the PAS over to observe with the MallinCams. One of the targets with the 8" f/4 Newtonian was Stephen's Quintet. Not only were all observers able to see the five galaxies that comprise this compact grouping, we

also saw live on the monitor NGC 7320C – a 16.7 magnitude galaxy just outside of the Quintet. According to Sam Brown, in his book “all about TELESCOPES”, an 8” scope is capable of seeing stars to magnitude 13.3 in a magnitude 6.2 sky. On the night of September 18th, the limiting magnitude at the Zenith was 5; thus the magnitude limit of my scope on the 18th was reduced to 12.1. However, a 16.7 magnitude galaxy was seen live on the screen of my 13” TV/VCR – a 4.6 magnitude gain. My 8” scope was detecting DSOs that would be visible to the eye in a 50”+ optical instrument. My scope had effectively grown in size!

Dark Sky Test on a Large Scope

Prior to Deep South Regional Stargaze 2004, I had only used the MallinCam™ on my 6” refractor at F/5, my 8” f/4 Newtonian, and a friend’s 8” Meade LX200 at f/6.3. I really wanted to see what was possible with the cameras under darker skies than my backyard and with a larger scope. At this year’s DSRSG, I finally got the chance.

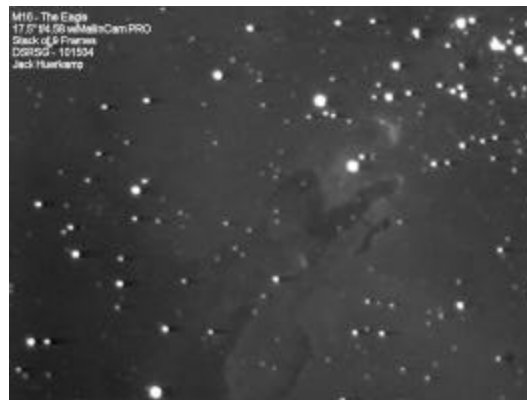
At this event, I used my 17.5” f/4.58 AstroSystems TeleKit with a Coulter primary mirror bought in 1981. To the TeleKit, I added a ServoCAT GOTO and tracking system, a laptop table, and a battery box. I did not have room for both the laptop and the DVD player on the table; so I had to forgo the laptop. I used the Argo Navis to guide the scope to all the targets I sought.

As there was no AC power on the observing field to run my 13” TV/VCR combo, I decided to try using a 7” portable DVD player to view the camera’s output. I covered the screen with a piece of 1/8” red, transparent Plexiglas. I also used the Sony Hi-8 HandyCam seen with the DVD player to record the camera’s output for later image processing.

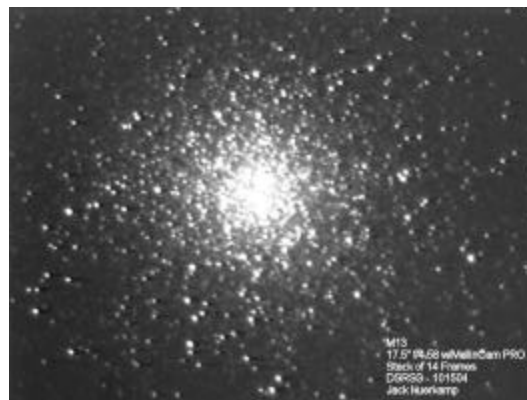


By moving the primary in its cell as close to the secondary as possible, I was JUST able to achieve focus with the MallinCam™ PRO. I could not achieve focus with the II Color. I need to trim off short sections of each truss tube and check to see if focus can be achieved. This will be done in the near future.

With respect to the combination of the PRO, 17.5” scope and the ServoCAT, the performance exceeded my expectations! One of the first targets I looked at was M16, the Eagle Nebula. The “Pillars of Creation” were easily seen. I had never seen this object with this level of detail in any scope before. The picture below is a stack of 9 frames using RegiStax and closely approximates the view on the monitor of the DVD player.



This was exciting and the crowd was beginning to form. I switched to an old favorite M-13. The center was totally over-exposed.



By varying the number of exposures and the gain, I could resolve stars across the cluster’s center.

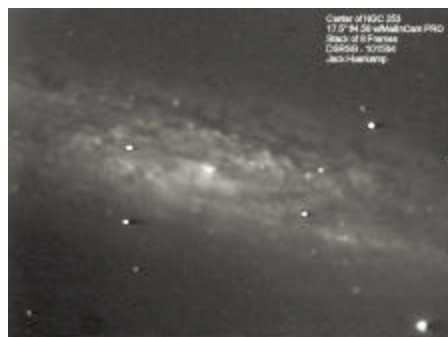
M57, the Ring, revealed at least two stars in the center and looking at the monitor I could see an 18.9 magnitude star just outside the edge of the planetary.



The camera performs like a 9mm eyepiece. Thus, in the TeleKit, the field of view was similar to what is



achieved at 225 power. The camera could capture a portion of NGC 253, the Sculptor Galaxy.



By now there were about a dozen people observing at the same time and seeing more on the screen than would be possible with the unaided eye. Someone from the Jackson club asked me to try to locate the supernova in NGC 6946. The ServoCAT slewed the scope toward it and the arms of the face on spiral drifted into view – along with SN2004et.



I had my copy of Burnham's Celestial Handbook with me, and I looked through them to find interesting DSOs to pursue. NGC 891 was high in the sky, so it was selected from the Argo Navis' internal database, and the GOTO command issued to the ServoCAT.

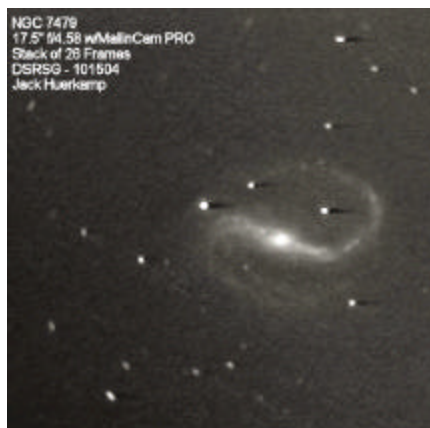
Editor's note:

The full-sized originals of Jack's pictures look far better than they do in the article. I had to play with contrast and brightness to make them show up well in our Adobe Acrobat Format.

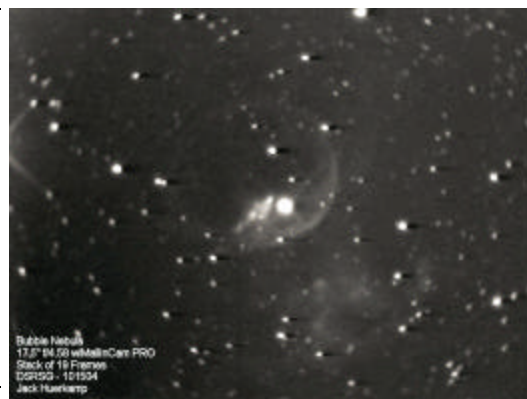


The galaxy drifted into view – extending diagonally across the screen of the DVD player. The dark lane showed lots of detail, varying in width and containing imbedded stars. This was one of my favorite objects of the stargaze.

Another prominently placed galaxy was NGC 7479 in Pegasus. It is a barred spiral with a bright nucleus and two spiral arms. Together the galaxy looks like a backwards letter "S".

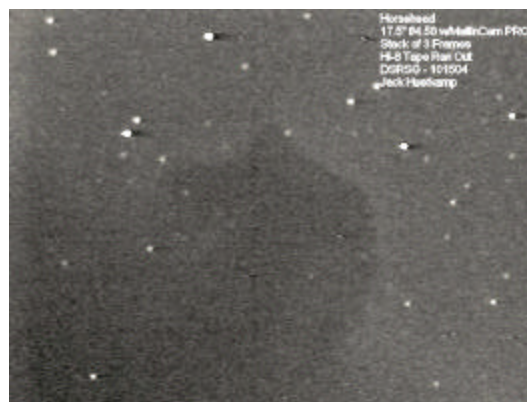


I finally ended the evening with two challenge objects – the Bubble Nebula, NGC 7635, and the Horsehead Nebula. The Bubble Nebula is a low surface brightness object that I have only seen a small portion of visually in the 17.5". The MallinCam™ equipped scope showed much more.



The view on the monitor was far superior to the picture shown here. There was much more subtle detail visible in the nebulosity to the bwer right of the image than this stack of frames could capture.

With respect to the Horsehead Nebula, it is a large, dark nebula silhouetted against a bright one. The image shown is very grainy as it is a stack of only three frames. I ran out of videotape just as I started observing the Horsehead. Increasing the number of frames in a stack helps to increase the Signal-to-Noise ratio of the image. I will have to re-visit this target to get a better image of it.



For information on the MallinCam™ Video CCD Observational System, you can visit my website, and click on the link with the same name:

<http://www.WaningMoonII.com>

jhuerkamp@bellsouth.net

The following article originally appeared in a slightly different form on my website about 5 years ago. It's hard to believe that even that recently there were literally hordes of Schmidt Cassegrain owners who were genuinely afraid to adjust their telescopes' secondary mirrors to achieve good collimation. Thankfully, the word has gotten out on SCT collimation over the last half-decade, largely thanks to the efforts of the good folk on the SCT User Yahooogroup mailing list. Unfortunately, there are still quite a few SCTs out there with "bad optics" that just need a little collimation tweaking to bring them up to speed. With that in mind, and also with the awareness that there'll be quite a few new Christmas Schmidts that need at least minor adjustment after the tender ministrations of UPS, I give you, once again...

The Pleasant Art of SCT Collimation

Rod Mollise

SCT collimation? When do you do it? How do you do it? Why do you do it? Does it feel good? Is it legal if you're under 21?

Truth be known, collimating a Schmidt Cassegrain Telescope, adjusting the alignment of its optics so it can deliver the best possible images, is easy to do. Much easier than messing with the mirrors on a big dobsonian or other Newtonian design reflecting telescope. You lucky SCT users have only got one user-adjustable optical element, the secondary mirror. The poor Newtonian owner must fiddle with her primary mirror *and* secondary mirror, and that secondary is moveable in several axes. All we've

got to worry about are those three silly, little screws on the front of the CAT.

And worry about them we should. Good collimation is *critical* for decent SCT performance. The difference between a collimated SCT and an uncollimated SCT, especially on difficult and detailed subjects like planets, is dramatic. Many, many of those old stories about how Schmidt Cassegrains deliver fuzzy, low-contrast images are directly attributable to telescopes that were never collimated or properly collimated. I mean, the SCT just seems so complex and delicate. Who in their right mind would dare to turn those three screws? Visions of a secondary mirror falling onto the primary with a bang dissuaded many an Orange Tube C8 or 2080 owner from even *thinking* about collimation.

Actually, an SCT is a simple and robust instrument, and you really have to work at it to cause damage. The only way it would be possible to send the secondary on a one-way trip to the bottom of the tube would be to unscrew all three collimation adjustment screws at once. If you follow the simple rule that warns you to never loosen a collimation screw until its "opposite number" is snug, you will never have to worry about mirrors in free-fall.

Preparations:

The first thing to do is have a look at the three collimation screws on your telescope's secondary holder/assembly. "Three?" you say, "I've got four." If you have four screws on your secondary holder, one will be in the center. Leave that center screw strictly alone, as in some early designs it holds the secondary mirror and its backing plate to the secondary mirror mount. In modern scopes, however, you've only got three. They screw into threaded holes on the secondary mirror's backing plate, and hold it

and the mirror in place. They also, of course, allow us to adjust the mirror's aim in push-pull fashion. *That's* why you don't want to loosen/remove all three. On some scope designs, they are all that keep the secondary in place, holding it against a central pivot point. Remove 'em all and KER-PLUNK!

Anyway, take a look at the screws and determine what sort of adjustment tool you will require. Older Celestron telescopes and all Meades use allen wrenches. A collimation wrench should have been included with your scope, but if not it should be fairly easy to determine the proper size. You need a wrench that fits solidly into the screw and which does not slip or strip. The simplest expedient may be to buy a set of (usually non-metric) wrenches. Modern Celestron scopes use the less convenient Phillips-head screws. Again, make sure you have the proper tool, in this case the correct size of screwdriver. You don't want a too large or too small screwdriver slipping, as you're working close to the surface of your corrector plate.

"*What* screws? I don't see any screws." If you have a 1990s or earlier Celestron scope, you may find yourself looking at a secondary holder whose surface is covered with an orange plastic disk. This disk is held in place by three tabs, and can be gently snapped off with the aid of a small flat-blade screwdriver. Once you've got it off, you might as well do what I do and put it aside. Save it in case you ever sell the scope, but leave it off. It serves no purpose other than to prettify the secondary assembly, and can be a pain to remove in the dark if you're ever faced with the need for a quick collimation touch-up after a bumpy trip to a star party. If you've got one of the Celestron Nexstar GPS scopes, you won't see screws either; they are hidden by a plastic cover that can be rotated to reveal them. Pretty slick, if unnecessary.

Once you've got the screws in view and the proper adjustment tool at

hand, all you must do is wait for good seeing. Good seeing is NOT as critical for collimation as it is for star testing a telescope. But it still must be good enough for you to be able to view a star's diffraction rings at high power and tell whether they are concentric or not. If the temperature differential between the place where the scope is stored and outside is high, give it 45 minutes to an hour to reach thermal equilibrium before attempting collimation.

Now, down to work. In its simplest form, SCT collimation is a two-step process.

Rough Collimation:

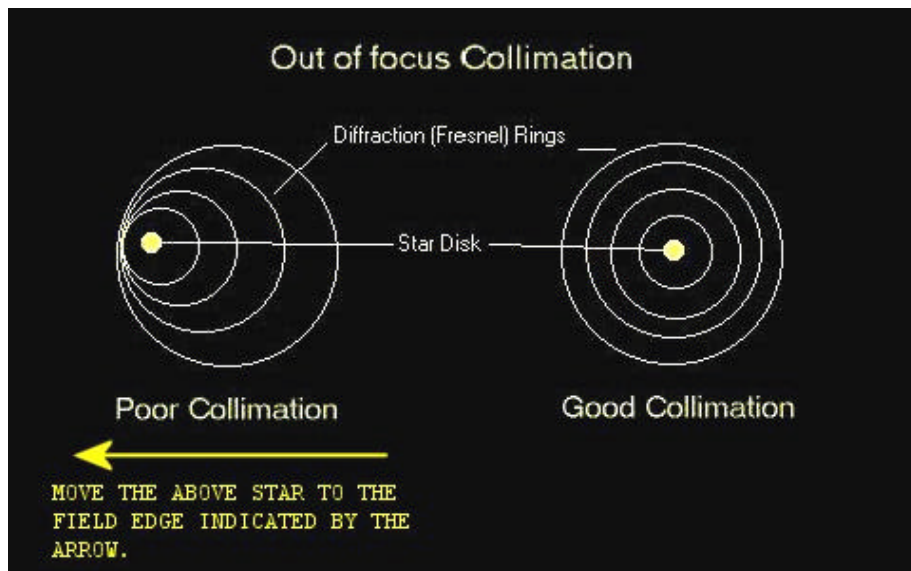


Set-up the scope and put a medium bright star in the field of an eyepiece—practically any eyepiece will serve, but I usually use a medium power 12 – 15mm one. As for which star, Polaris would be a



nice choice; it's about the right magnitude, and won't be affected

Puzzled about which screw to turn? Here's a trick you can use during



much by drive errors/polar

alignment problems. Defocus the scope a lot, keeping the star carefully centered, until Polaris becomes what looks like a round "globe" or blob of light with a dark center. Does the dark spot (actually the shadow of your **secondary**) seem more or less centered? If it does, move on to the next step. If not, you'll need to adjust your secondary.

Ready your tool, whether allen wrench or screwdriver, pick a screw and gently tighten it a little. If the screw is so tight that you can't easily tighten it, pick another. Observe how the dark spot moves, and try the screw's opposite number if it doesn't move in the right direction. Adjust the relevant screw(s) by small amounts, about 1/10 of a turn each time, recentering the star between screw adjustments until the dark spot is centered. Again, always adjust your secondary by tightening the screws. Only if a screw is completely tightened and can't be turned anymore should you then loosen the opposite screw to continue movement in the same direction (never, **never force anything**, natch).

both rough and fine collimation that will make choosing the correct screw a little more obvious. Look at the dark spot. Observe in which direction it's offset with regards to the bloated, out of focus star-disk. Adjust the scope via the RA and dec slow motions or your hand paddle until the dark spot is on the edge of the field in this direction. Then, *turn the screw/screws that will move dark spot/star globe toward the center of the eyepiece field again*. Tighten or loosen the collimation screws a small amount until the star globe moves back toward the center of the field (turning a collimation screw will always move the star in the field even though you haven't touched the mount). Now recenter the star in the field. In addition to the whole star globe having moved to the center of the field once more, you will note that the dark spot has now moved closer to the center of the bright star globe. If it needs to move more, go back to the same field edge and repeat. If you've gone too far, move to the appropriate field edge as indicated by the dark spot's offset and proceed in the same way as before.

Fine Tweaking:

OK, you've done a rough collimation using the secondary's shadow. But this *ain't* good enough, especially if you like to look at planets. Let's do a fine collimation. Replace the eyepiece you've been using with one that yields around 200x. Move the star *almost* into focus until you see a series of diffraction rings. You want to make the star look as much as possible like a little bullseye target. In some cases, you may find this "target" a little clearer on one side of focus than the other.

Is everything centered? Does the combination of the star's airy disk and rings look like a perfect little bullseye? If yes, you're done. But if the rings seem "skewed" to one side or another, you've got more collimation to do, pardner. Adjust your secondary (by very small amounts) just as you did in rough collimation, until the rings are concentric. As during rough adjustment, when you turn the screws, the star will move in the field. Always *recenter* the star and check things out before making further adjustments. Keep on going until you've got a nice bullseye with everything centered and concentric.

In Focus Collimation:

Want to get things adjusted even better? If you've got a really good, steady night, you can go to the 4th stage of collimation, collimating by observing the airy disk and brightest diffraction ring of a star **IN FOCUS**. To do this, you'll probably have to run the power up to at least 300x – 350x. Once you've done that, take a look at the star. You should see the bright pin-prick of light that is the airy disk. If your magnification is high enough, and the air steady enough, you should also see a ring surrounding the airy disk. If this ring is unbroken, your collimation is dead on. If it appears broken and incomplete, however, adjust as previously until it forms a complete ring around the airy disk (you'll have to use even smaller movements of

the secondary adjustment screws



than you did in the fine stage).

Further Tips:

Should you collimate with your star diagonal inserted into the scope? This is controversial, since poorly made diagonals can affect collimation, but my gut feeling is that you should collimate with the diagonal in place if you plan on using it during your observing runs.

Once collimation is complete, most SCTs hold it very well. But **DO** check it every once in a while. If you mainly use your scope at home, you may be able to go years between collimation sessions, but a scope that travels to distant star parties will require somewhat more frequent adjustment. If your scope requires very frequent collimation, however—for almost every observing session—something is wrong. The need to collimate frequently is most often a symptom of a secondary whose adjustment screws have *all* been left loose.

If your scope uses allen wrenches, one cool trick is to obtain three allens of the same size. Insert one into each of the three screws (they'll stay in place without complaint if they are of the proper size). Not having to remove/insert the wrenches when you switch screws during adjustment makes collimation much easier. Want to make it even *easier*? Make handles for the wrenches out of small wooden dowels affixed to each wrench with tape.

What if you have Phillips-head screws, or just don't like allen wrenches? Think about buying a set of Bob's 'Nobs. These knob-headed replacement screws make SCT adjustment easier than you ever thought it could be: <http://hometown.aol.com/rkmorrow/myhomepage/index.html>

What if you're often affected by very poor seeing, and that makes collimation difficult? It is possible to use an artificial star for SCT collimation, and I'll try to run an article on this subject soon, but it's my observation, that most folks do have seeing good enough to do a star-collimation, which is the easiest way to go. If seeing is a problem for you, wait at least a couple of days after a front passage, and keep an eye on the Clear Sky Clock for your area: <http://cleardarksky.com/>

Alright! Now, everybody get out there and **COLLIMATE!**

Department Store Scopes: Threat or Menace?

Rod Mollise

Are department store telescopes, the 60mm aperture 500 power wonders that appear in the local Wal-Mart every November only to flee with the old year in January, a

bad thing for amateur astronomy? A lot of us think they are, due to their decidedly low quality, which most of us fear will turn-off new sky watchers before they even get started. But are they the evil menace most of us think they are? And what is the state-of-the-art in this humble class of scope?

Certainly there are some insanely horrible telescopes for sale now. Some that only barely deserve to be called "telescope" at all. Plastic single-element refractor objectives ain't exactly unheard of, I'm afraid. These bottom-of-the-barrel scopes are mostly found in toy stores (Toys 'R Us is a prominent offender), however, and don't bear the usual Tasco-Bushnell-

Meade logos of the "true" department store 60x500 special. Toy

telescopes have been around since forever, and are just that, *toys*. Probably a few parents think they can get a good scope for li'l Suzie for 10 or 20 bucks, but I'd guess most are aware that telescopes of this type are just playthings, nothing more, and will not help their Junior Scientists get into college.

From what I can determine, there are no good or even useable toy telescopes for sale at this time. But it hasn't always been that way. In the so-called "good old days" of the 1950s and early 60s, not all of 'em were junk. I remember the Gilbert (the famous maker of Erector and chemistry sets) sub-3-inch reflectors fondly. I *recall* them as being able to do a pretty dad-burned good job on

the Moon, at least. Is that just a warm, fuzzy childhood memory with no basis in fact? Now, I can find out. I've recently got my hands on a vintage Gilbert 2.5" reflector complete with case and original documentation. When I get some time, I'll see what the silly little thing can really do. Some time in the early 1980s, though, coincidentally about



Rod finally got his Gilbert after waiting 40 years. Christmas 2004 at Chaos Manor South. See: <http://members.aol.com/rodmas1017/rodspage.html>

the same time chemistry sets, serious chemistry sets, began to disappear from toy retailer shelves, it appears that the toy scope makers decided "why bother?" when it came to producing working toy store telescopes.

Toy scopes aside, the Department Store Scope (DSS) as we usually think of it is alive and well. 60mm refractors, 4.5 inch reflectors, and, increasingly it seems, 3 inch reflectors (and even a 3 inch refractor or two), are prominent fixtures in discount houses at Christmastime. How are they these days? Better or worse than they used to be? Both. They are all a *little* better in that most now use 1.25" American Standard eyepieces,

which even at this price point tend to be slightly superior to the Japanese Standard .965"ers of yore. The fact that the scopes can accept 1.25" oculars also means that a person with real interest can buy a few inexpensive Chinese plossls and improve almost any DSS quite a bit. As in the past, those DSSes I've been able to checkout have pretty

good objectives and (spherical) primary mirrors.

One thing that needs to go? Nay, *must* go? Now that the frankly dangerous eyepiece Solar filters that used to be found in the box with every DSS are history (in most cases), the next candidate is the putrid barlows included with almost every DSS. These

"barlows" really don't work, and provide the single largest

source of frustration for DSS owners. Kids (and parents) just *assume* they should start out with the barlow and that 4mm Huygens. It's all about POWER, right? Unfortunately, with this setup even a 4.5 inch Newtonian with a good mirror will turn the Moon into a blur, into something looking more like a custard pie than a planet—if even the Moon can be placed in the field of a shaky scope at these high powers.

How else have DSSes changed since the 70s and 80s? Department store scopes, all of 'em, are now far more heavily laden with plastic than they used to be. There's nothing wrong with plastic if it's done right. An example is the Orion StarBlast.

This 4.5 inch Chinese rich-field reflector uses a plastic tube ring and focuser. In the StarBlast, these items work very well; they are reasonably well designed and executed. But in a DSS, plastic usually translates as “cheap and flimsy,” with the makers employing poor quality moldings in all the wrong places—especially in critical areas of telescope mounts.

So how do manufacturers and importers lure buyers? Instead of equipping their scopes with the decent aluminum castings used, for example, in the 1970s Tasco scopes’ focusers and mountings, today’s DSS importers are using their shrinking resources to dazzle prospective buyers with digital setting circles and goto, since these things cost less to produce than a good mounting or focuser and are actually likely to be more impressive for the uninitiated.

These “shrinking resources,” as in “shrinking dollars,” are a big problem in the DSS arena. Most parents still want a scope for the kids that costs less than two hundred bucks. Many expect to pay considerably less than 100 U.S.\$, just as DSS buyers did 30 years ago. The dollar buys far less these days than it did in the 70s, of course, and beyond switching from Japan, to Taiwan, to Mainland China, as the years have gone by, DSS importers have had to instruct their sources to cheapen *everything* having to do with these telescopes in order to bring ‘em in for “traditional” department store scope prices. In some cases, this is made up for by modern production methods, but not in all. Not hardly.

How about the above-mentioned goto and digital setting circle features that some of the scopes now sport? Can goto or DSCs work on such cheap instruments? I dunno. I’ve not had the chance to use a DSS with these features yet, but I have my doubts. Certainly, Meade was able to implement reliable goto for a relatively low price

for its ETX 60 and 70, but at the 100 dollar or less level? Yes, I have my doubts.

What else is new in DSS land? Many of the familiar scope importers have disappeared over the last 30 years, with Jason, once a big name, apparently gone, and the much-reviled Tasco now being a mere subsidiary of Bausch and Lomb. But the most noticeable change on the department store shelves? You’re now as likely to see “Meade” on a department store scope box as “Bushnell.” Both of our famous serious telescope makers, Meade and Celestron, have sold imported scopes that fully qualify for the DSS ranks off and on since at least the 80s. Only Meade has really penetrated beyond science stores and into the local Wal-Mart and Costco, however. Quality of the DSS Meades? No better or worse than Tasco or Bushnell or any of the rest from what I can tell. Is this an indictment of Meade? I’ll leave that for you to decide, but keep this in mind: the money made on this level of telescopes (and binoculars) probably serves to help subsidize the kind of Meade scopes amateur astronomers crave.

I’ve been talking about these scopes as if they all are cut from exactly the same cloth. That’s not exactly true, of course. Some brands are better than others (even though the scopes may be produced in the same Chinese factories). Unfortunately, this seems to change month by month and year by year. Today Bushnell may be better. Tomorrow the Meades may get a leg up on them. There is also often a fairly large quality difference depending on the cost of a DSS.

A few dollars seems to make far more difference here than it does with more expensive telescopes—even with the amateur astronomer-level Chinese imports. There can be and usually is a big, BIG difference between a 50 dollar DSS scope and a 100 dollar one. Keep in mind, though, that while you *do* get what

you pay for to some extent, nothing I’ve seen in the department stores recently is as good or useable as, say, the old Tasco 11TR “red tube” 4.5 inch Newtonian reflectors that were imported from the 60s to the 80s. I bought one of these in an Air Force Base Exchange in the mid 1970s, and found it was *surprisingly* good despite having a spherical mirror. Admittedly, even in a BX, I paid quite a bit more for it (in real dollars) than the 100 - 150 dollars most current four and a half inch DSS Newtonians command.

So the kids who opened those pretty boxes, the ones emblazoned with the full color Hubble Space Telescope pictures, this past Christmas are in for an agony of bitter disappointment? No. Most of ‘em probably *aren’t*. Expectations play a huge role in the DSS game, you see. Many kids and parents will be AMAZINGLY HAPPY AND ASTOUNDED just to be able to see craters on the Moon, the moons of Jupiter, or a bright star. *Most* of the DSS scopes can deliver on these simple goals with relative ease.

What does this yearly spate of Christmas scope buying do to our hobby? I don’t think the DSS has hurt the pursuit of amateur astronomy. Anyone, young or old, with a grain of real interest will at least pick up a copy of *Sky and Telescope* or *Night Sky* or wander into an astronomy club meeting, and will quickly realize that a 50 buck scope from Wal-Mart does not represent the state of the art in amateur equipment. With a little guidance, we can ALSO educate DSS buyers that it’s possible to upgrade to the much better for not too much more dough (less than \$200 for a StarBlast or Short Tube 80 setup) if they are truly interested. If this is not possible, almost any DSS can be improved for next to nothing (by bracing tripods, replacing stripped or poor quality hardware, etc.). If nothing else, a DSS, bad as it may be, can serve as a rough introduction to astronomy

and result in a young person finding her way to her local astronomy club.

While the average amateur can help a new DSS owner improve the scope, in many cases the DSS performs its role just fine out of the box, *thank you very much*. Beyond a few peeks at the Moon and a bright star or two, *most* purchasers are not really interested in amateur astronomy and telescopes *and never will be*. What they *are* buying or having bought for them is a *totem*, an icon that represents *science and education*, and if that's all that's wanted, that's OK. In the 1960s, many working class and lower middle class parents really sacrificed to buy the kids a set of encyclopedias. Sure, Missy could have used the set down the street at the library, but the *real* reason Mom and Dad bought those books had nothing to do with practicality. No, what they were buying was *hope and inspiration*, hope for their kids to excel and better themselves. Many DSSes are bought for the very same reason today. Not everyone, after all, is destined to live life dreaming of C14 SCTs and 30 inch StarMaster dobsonians.

Even if a DSS owner seems to be on the track to bigger and better things in amateur astronomy, please be careful, especially when dealing with kids, in criticizing their DSS scopes too heavily. These Christmas presents were, even in this relatively affluent era, often scrimped and saved for by parents of modest means. If you're asked why a scope doesn't work well, my advice is to mention *details*. Don't say, "Because your scope is department store crap from Wally World." Instead, say, "The tripod is a little shaky, the mount is a little flimsy, and your mirror needs to be collimated, but if you bring your scope to the next club meeting, we can help you fix those things." Remember, as above, that tiny tube perched on that spindly tripod may represent far more than peeks at the

Moon; it may be the embodiment of a parent's and a child's hopes and dreams.



Hunting Gravitational Waves: Space Technology 7

Patrick L. Barry and Dr. Tony Phillips

Among the mind-blowing implications of Einstein's general theory of relativity, direct verification is still missing for at least one: gravitational waves. When massive objects like black holes move, they ought to create distortions in space-time, and these distortions should spread and propagate as waves--waves in the fabric of space-time itself.

If these waves do exist, they would offer astronomers a penetrating view of events such as the birth of the Universe and the spiraling collisions of giant black holes. The trick is building a gravitational wave detector, and that's not easy.

Ironically, the gravitational waves spawned by these exceedingly violent events are vanishingly feeble. Gravitational waves exert a varying tug on objects, but this tug is so weak that detecting it requires a device of extraordinary sensitivity and a way to shield that device from all other disturbances.

Enter Space Technology 7 (ST-7). This mission, a partnership between NASA's New Millennium Program and the European Space Agency (ESA), will place a satellite into a

special orbit around the Sun where the pull of the Earth's and Sun's gravities balance. But even the minute outside forces that remain -- such as pressure from sunlight -- could interfere with a search for gravitational waves.

To make the satellite virtually disturbance-free, ST-7 will test an experimental technology that counteracts outside forces. This system, called the Disturbance Reduction System (DRS), is so exquisitely sensitive that it can maintain the satellite's path within about a nanometer (millionth of a millimeter) of an undisturbed elliptical orbit.

DRS works by letting two small (4 cm) cubes float freely in the belly of the satellite. The satellite itself shields the cubes from outside forces, so the cubes will naturally follow an undisturbed orbit. The satellite can then adjust its own flight path to match that of the cubes using high-precision ion thrusters. Making the masses cube-shaped lets DRS sense deviations in all 6 directions (3 linear, 3 angular).

ST-7 is scheduled to fly in 2008, but it's a test mission; it won't search for gravitational waves. That final goal will be achieved by the NASA/ESA LISA mission (Laser Interferometer Space Antenna), which is expected to launch in 2011. LISA will use the DRS technology tested by ST-7 to create the ultra-stable satellite platforms it needs to successfully detect gravitational waves.

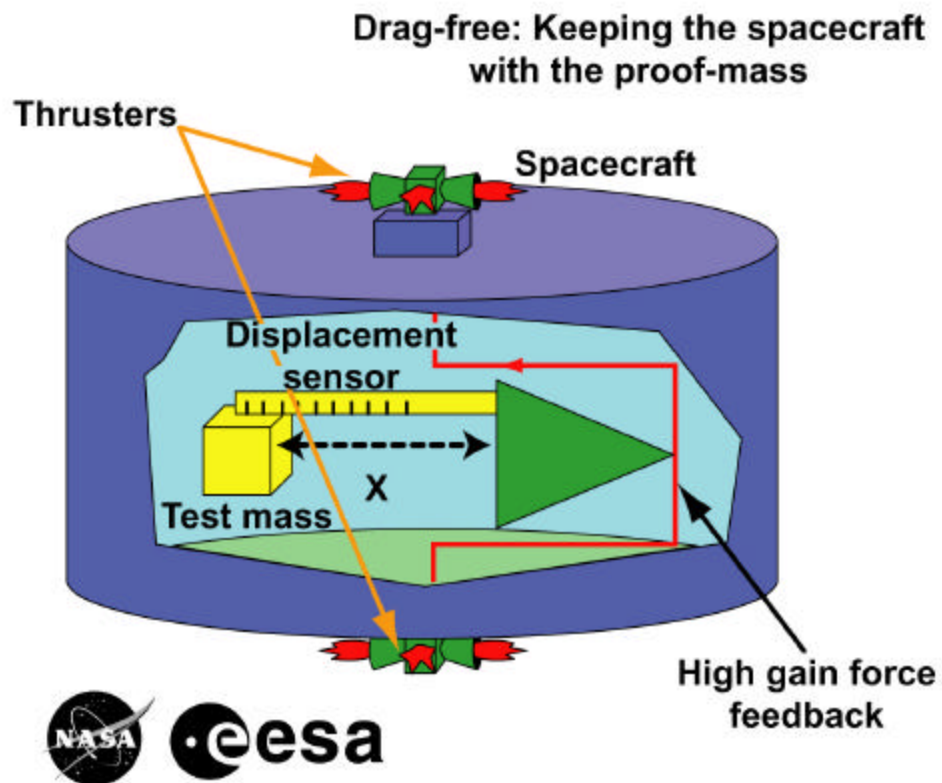
If ST-7 and LISA succeed, they'll confirm Einstein (again) and delight astronomers with a new tool for exploring the Universe.

Read more about ST-7 at <http://nmp.jpl.nasa.gov/st7>. For kids in a classroom setting, check out the "Dampen that Drift!" article at http://spaceplace.nasa.gov/en/educators/teachers_page2.shtml.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Caption:

Space Technology 7 will test a technology to be used in detecting gravitational waves in space.



My Back Pages

"Crimson flames tied through my ears
Rollin' high and mighty traps
Pounced with fire on flaming roads
Using ideas as my maps
"We'll meet on edges, soon," said I
Proud 'neath heated brow.
Ah, but I was so much older then,
I'm younger than that now."



Ah, Mardi Gras approaches...(early this year) with its parades, balls, revelry, and, unfortunately, hermetically sealed mayo jars (kept on Funk and Wagnal's porch for a fortnight) hefted by those ridiculous rascals BEAVIS AND BUTTHEAD (who could USE masks!). At least said jars are said to contain those delectable...

What, oh what, could it be?! The answer was forthcoming soon enough:



Rumours

*The **MEADE ANNOUNCEMENT** (in capital letters, natch) had us all going for days and days. Hundreds of posts on the Yahoo groups and sci.astro.amateur all asked the same thing, "What does Meade plan to offer up to fulfill the promise of the headline on their website?"*

In 1992 Meade introduced the LX200, and changed the face of astronomy.

On January 3, 2005 Meade will do it again...

What to make of these upscale (but relatively reasonably priced) Ritchey-Chretien-Telescopes (RCTs)? The inimitable Uncle Rod's initial musings were these:

"My thoughts on these new scopes?"

Well, since you asked...WHAT? YOU DIDN'T ASK?! I'm gonna tell you anyway!

They look impressive--certainly we'll have to, as always, see how they perform, of course--but they look great in the

pictures.

Personally? I am starting to plan an observatory project to be done in the next year or three, and, while I'd originally planned to put an NS11 in it, I'm leaning a little bit toward a Meade or Celestron 14 inch scope at this juncture.

Does that mean the RCX, now?

Unfortunately, the RCX 400, no matter how impressive, carries a price tag of well over 9K delivered. I could - MAYBE- spend that much for a "retirement scope" (if you want to call it that (I've still got a long time to work), but it wouldn't be easy, or painless, or, perhaps, justifiable. That's the big question is, "Do I need one for what I do?"

YES, I'D LOVE TO HAVE ONE. And emotion often has as much to do with scope purchases as "need," but I'm extremely satisfied with SCTs for my applications, casual visual observing and serious planetary imaging. I guess if I were a deep sky imager, I might be more excited.

I think it's encouraging that one of the manufacturers finally LISTENED and is offering an integrated dew heater.

USB: 'Bout time!

Secondary focusing system: nice, but not a HUGE deal compared to the LX200 with the microfocuser and mirror lock.

Tripod: dunno about this "no spreader" business.

Do I WANT one? Dang right. One of these puppies probably is a little too rich for my blood, however."

And what of Celestron? Nothing quite so flashy... Their latest coup is the introduction of a scope at the other end of the price scale, the NS8i Special Edition. This wonderful looking thing is basically a Nexstar 8i. BUT...one with a beautiful orange anodized tube. That's right, homage to our old friend the OT C8! The other new thing here is the *software*. Apparently the scope uses a different alignment routine, one that doesn't infringe on Meade's (laughable, if you ask me) **patents**. Only slight fly-buzz in the ointment? I'm told the scope won't work with the current version of NexRemote (aka HcAnywhere), but that steps are to be taken to rectify that shortcoming.

For \$1399.00 with Celestron's new 2 year warranty, this is a lot of scope for a beginner—or anybody else.

What else from the Torrance gang? I'm told they aim to release a camera to compete with Meade's new low cost Deep Sky Imager. I'd like to see them succeed here, since, while I like the Meade DSI VERY much, I'm kinda feelin' left out since the included software won't control my Celestron scopes...

In the weird scenes inside the gold mine department... As if there weren't enough people on s.a.a. crusading against green laser pointers, the government seems to be getting into the act. While it is highly unlikely that a green laser pointer like those used by amateurs to aim scopes and point-out celestial sights could be used to blind a pilot at 15,000 feet, I'm afraid the government may jump on this "possible terrorist threat," since it would show that our beloved feds are DOING SOMETHING, even if there's nothing that need be done. Sigh.

Have you seen Rod's new column on the Anacortes web site? "Uncle Rod's Corner" is already getting rave reviews, so check it out at <http://www.buytelescopes.com>

The Anonymous Astronomer

The Wrap-up...

Ho-hum. Things are quiet here. We're into the usual early-winter doldrums at Chaos Manor South. Everybody's been busy during the holiday season, the skies have been cloudy, and the fall star party season is just a memory. BUT...things will get better soon, I promise! Before you know it, birds will be chirping, seeing will be settling down, Mars will be back, and the cycle of star parties will begin anew.

As always, I'm looking for articles on any aspect of **amateur astronomy**: Observing, equipment/book/software reviews, poems, personal experiences, star party reports, fiction, cartoons, you name it!

If you're a *software vendor* or *equipment maker*, and would like to see your product reviewed here, just give us a shout!

If you have something for me, well, send it on to yer ol' Uncle Rod at RMOLLISE@aol.com

See you all in April!

--Rod Mollise