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## 16-INCH F/4.5 COLLAPSIBLE-TRUSS DOBSONIAN FROM NEW MOON TELESCOPES

### NEW DESIGN APPROACHES AND OLD-FASHIONED CRAFTSMANSHIP

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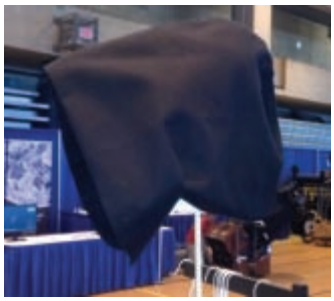
# Contents

## Industry News





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# Editor's Note

Gary Parkerson, Managing Editor

## FLYING SOLO

It has become an *ATT* tradition that its post-NEAF and NEAIC issue include a special report on both industry-leading events. Unfortunately, I made the foolish decision of attending solo this year, which meant spending the majority of the NEAF weekend manning the *ATT* booth rather than hopping from exhibit to exhibit, enjoying the show from the perspective of an attendee. I'm still first at heart a consumer of astro products and an amateur reporter a distant second, so, no, it won't happen again.

The good news is that, because I actually stayed in the *ATT* booth for most of the weekend, I was able to meet even more of you in person; the bad news is that I returned home sans memory cards full of photos and pages full of notes detailing the many amazing products displayed at NEAIC and NEAF. So, no post-NEAF/NEAIC special section this year, but that leaves room for even more in-depth feature articles covering great astro products.

That's not to say the trip produced no content for this and future issues. As I recall the broad strokes of NEAF, among the highlights was encountering Ryan and Heather Goodson as they were setting up. Of course, being a sucker for big, gorgeous, meticulously crafted Dobsonians, it was inevitable that their New Moon Telescopes exhibit would capture my full attention, even during that quick pre-show walk-through. One of the happy results of that encounter is the cover story for this issue of *ATT*. No, I didn't come home with completely empty hands, or head, and am confident you'll be hearing much more from New Moon Telescopes in coming years.

The Goodsons' telescopes captured my attention, as did the Goodsons themselves, for the simple reason that they represent one of the aspects I love most about the telescope industry. Astronomy enthusiasts are primarily served by what are essentially cottage enterprises, populated with business people and craftsmen for whom their astro products and services represent labors of love. Most are family businesses, as is *ATT*, a fact that is reinforced with each trip to NEAF as I am privileged to again greet in person the family partnerships who gather there each year. Throughout the years, six members of my family have represented *ATT* in person at NEAF or NEAIC.

As for the Goodsons, Heather manages the company's website and books, freeing Ryan to focus on the hands-on work of lovingly crafting New Moon Telescopes one by one. Together they are growing an enterprise that is a credit to this industry, because it is so very representative of the best traditions of this industry. The flattering words I'm devoting to Ryan and Heather could be written about most astro-enterprise principals who gather each year at NEAF and NEAIC, and I'm pleased that the Goodsons reminded me of that fact. Witness the Naglers, Christens, Weatherwaxes, Marises, Deises, Bisques, Hands, Nikins, Simstads, Brotherstons, Teeters, Thomases, Yangs, Peterses, Fosters, Glatters, Davolis, Waites, Remakaluses, Ishikawas, and countless more I should and would list here were this

space not limited.

For me, preparation for NEAIC and NEAF involves, among other things, consulting the lists of vendors who have signed on to participate, to see who there might be new, and it was on the NEAF list that I first became aware of New Moon Telescopes. I Googled the name and discovered the Goodson's company website, as well as the beginnings of a YouTube channel that the couple is populating. Their videos provided the perfect introduction to them and their telescopes, including their unique collapsible-truss design. Google will find them for you, too.

As I said, I didn't return home completely empty handed. From the viewpoint of exhibitors, the Thursday and Friday of NEAIC are far less hectic than is NEAF weekend, if only because those attending the two-day imaging conference disappear into symposium sessions every hour or so, leaving exhibitors time to visit among themselves. So, I had far more opportunity there to study all that was new in the astrophotography field. For example, I learned that the Tele Vue team is collaborating with the Finger Lakes Instruments crew to produce a complete premium, ready-to-image system integrating the TV-NP127is refractor with FLI's Atlas focuser, filter wheel and camera. *ATT* will have in-depth coverage on this and other imaging-product developments in the news sections and feature articles of future issues.

Attending NEAIC again also reminded me of what an amazing job Bob Moore and Mike Peoples do in planning, organizing and managing that event. While NEAIC, on its own merits, draws astrophotographers from around the world, for anyone planning the journey to NEAF, adding NEAIC to their agenda is truly a no-brainer. As for NEAF, the 2013 edition was Ed Siemenn's first in the role of chief, and from the perspective of this exhibitor, the show was flawless. Congratulations to Ed and all the members of the Rockland Astronomy Club who worked so tirelessly in making NEAF 2013 yet another world-class success.

I look forward to seeing you all again at NEAIC and NEAF 2014!

# The 16-inch f/4.5 Collapsible-Truss Dobsonian From New Moon Telescopes

## New Design Approaches and Old-Fashioned Craftsmanship

By Damian G. Allis, Ph.D.

New Moon Telescopes (NMT, newmoontelescopes.com) is a very recent addition to the list of manufacturers of custom Dobsonians, having made their first company appearance at the Kopernik Winter Star Party (kopernik.org) this past January and their commercial appearance at NEAF 2013 this past April.

While NMT is now making itself known to the larger amateur astronomy community, NMT is no secret to Central New York observers. Amateur astronomers in several CNY astronomy clubs have seen the expert woodworking skills and design choices of NMT's owner and sole craftsman, Ryan Goodson, first-hand, giving CNY observers and their always unpredictable weather conditions the honor of being NMT's original customer base both in rebuilds and new Dobsonians.

My own experience with NMT goes back to the company's beginning, as I am the proud owner of NMT #1, a "lefty" 12.5-inch Dob equipped with NMT's current choices for premium optics and hardware. The rapid progress in NMT's design work and prototyping can be seen in the

**Image 1 - The rocker box and mirror box – pinned box joints and finish.**

speed at which the original split-block design (used in NMT #1) was shelved over the course of several months in favor of a new collapsible-truss design (used in #8) that is replete with benefits over any other truss designs I've used or seen.

In seeing both Ryan's early design ideas and his first NMT prototypes, I was sure my specific needs would be easy for him to meet: I wanted a scope I would have to buy only once (that is, the last 12.5inch scope I would ever feel need to purchase) that would survive constant traveling and group use at public viewing sessions with the Syracuse Astronomical Society and, currently, at lecturing and sidewalk astronomy outreach sessions with CNY Observers & Observing (cnyo.org).

Admittedly, I am not a "building" amateur astronomer and definitely do not foresee myself making the pilgrimage to Stellafane to learn how to grind a first mirror. My experiences with NMT scopes are as an avid observer who wanted portability and the perfect view in a scope that combined custom-build craftsmanship with out-of-the box assembly ease.

Ryan, who had already done the bookwork on primary mirror, secondary mirror, focuser, and other hardware options, made my component selections for NMT #1 easy. Ryan's recommendations two years ago are the current NMT options for fellow only-once purchasers – MoonLite Focusers, AstroSystems Spiders, Antares Optics secondary mirrors, and primary mirrors from Lightholder Optics (though NMT has recently announced they would be pleased to work with any optician upon request).

Ryan's design choices have evolved over the past few years to improve the functionality of NMT scopes, but the craftsmanship and attention to detail remain the same – NMT #1 is in as good a condition today as it was at purchase – quality components and rock-solid construction produce a scope that, in my case, remains flawless in its finish and has had zero problems (wear, balance, or otherwise) of any kind going into its third year of lectures and star parties.

## First Impressions

I suspect that the real merit tests of appearance and, in the case of NMT's collapsible truss, a novel contribution to Dobsonian design, is the vendor floor at NEAF. The NMT booth featured a customer's 18-inch f/5, the 16-inch f/4.5, and a custom build for a new owner's own 8-inch mirror. Comments at the booth and in subsequent online forum discussions make constant reference to the beautiful finishes and liquid-smooth motion.

The fully assembled 16-inch scope weighs under 100 pounds, is easily maneuvered by one person with its removable wheelbarrow handles, and packs up for transport in a compact car. One does not usually use "portable" to describe a 16-inch Dobsonian, but NMT has done its best to balance weight and strength into a single scope. Portability is instead engineered into the design both by the reduced weight of the separate components and by the ease of assembly of the novel collapsible-truss design (in this case, "portability" also refers to the reduced hassle of getting your scope out and set up in the first place).

NMT's reports from NEAF have been excellent, including new sales and requests for rebuilds based both on the quality of the displayed scopes at NEAF and Ryan's personal knowledge of all things Dobsonian (it was a treat to listen to his design process being described in detail as he pointed out even the smallest features on the three scopes).

## Zooming In

After taking in the size of the scope itself, the first thing that draws the eye is the woodwork of the mirror and rocker boxes. The craftsmanship and finish are as near perfect as one would hope to find. This visual appeal goes back to the NMT building process – one person is singularly responsible for the selection of wood, the cutting, the assembly, and the finish.

Unlike a larger manufacturing output where slight offsets in seams, tightness or looseness in mass-produced components, or slight differences in finish due to variations in the tones of the individual wood might occur, the NMT mirror box, rocker box, and secondary cage are worked jointly with the final product in mind. The pinned box

Image 2 - The top of the mirror box, showing the truss locking screws, mirror cover, and truss placement positions.

Image 3 - A side view of the crescent bearings and matte-black interior of the rocker box.

(or finger) joints that define the look of the NMT mirror and rocker boxes are both visually attractive and finger-touch smooth (**Image 1**). The result of using the pinned box joint approach is a mechanically stronger mirror box as well, an important benefit of NMT's other selections in the 18- to 24-inch range. In the 16-inch and smaller scopes, this assembly method guarantees a rock-solid base as good at protecting the mirror as it is assuring smooth and stable scope motions.

Grade B/BB Baltic Birch Plywood is used for the construction of the rocker box (3/4-inch), mirror box (1/2-inch), and secondary cage (1/2-inch), a wood known for its strength and wear resistance. The hand-rubbed finishing process involves multiple single-coat and sanding steps, followed by a final hand-brushed outdoor varnish coat to produce both great wear resistance and fine grain detail on inspection.

The result is a scope that is everywhere smooth to the touch and visually attractive. NMT offers a selection of colors (Red Mahogany, Red Maple, and Special Walnut, Colonial Maple), but my personal preference is the natural Baltic Birch finish, followed closely by the Colonial Maple (both of which make the box joints and darker components stand out more).

## Mirror Box

The 16-inch mirror box is described on the NMT website as "low profile." This is most definitely not meant to infer that some compromise has been made in the interest of size or portability. A near necessity of the collapsible truss design NMT employs is an accessible surface area at the top of the mirror box to stably place the secondary cage/truss assembly before hand-screwing the truss bases into place. This is one design point that may keep the mirror

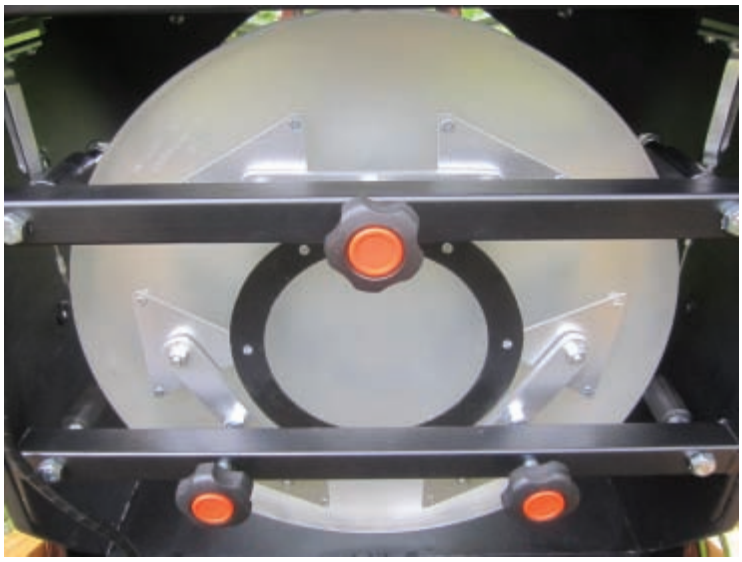

Image 4 - The mirror cell and finger screws.

Image 5 - The 18-contact floating mirror cell in isolation.

box in NMT designs from being reduced to super low-profile scaffolding-like mirror box designs without serious consideration of how to combine the positioning of the secondary cage/truss assembly with protection of the primary mirror during assembly. The current box design provides four corners with ample room to place, then fiddle slightly as needed with, the truss bases (**Image 2**).

The woodwork of the mirror and rocker boxes is completed with a matte black finish on all inner surfaces and two 26-inch outer diameter crescent bearings ("waxing" when the scope is horizontal, "waning" when it's vertical, **Image 3**). The crescent design and placement have the advantage of moving the mirror box farther aft of the pivot point as the scope is oriented more horizontal, increasing the balance and stability of the scope for those who insist on capturing first light of an object just as it comes over the horizon.

## The Mirror Cell And PLOPing

As part of a complete design process, NMT has done their own mirror-cell analysis using David Lewis' *PLOP* program. As stated on the davidlewistoronto.com/plop/ website, "It shows how to build mirror cells that outperform the conventional ones, by using CAD to optimize the cell design. As a result, it is possible to reduce the wavefront error by as much as 50 percent compared to a conventional design, or to support a mirror up to about 20 percent larger than typically thought possible."

The NMT 16-inch mirror cell is built completely in-house featuring an 18-contact floating point design with a steel sling that adjusts on two linear bearings where attached (**Image 4**). The only restriction on the mirror is gravity – it floats otherwise unrestricted in the cell (**Image 5**). The adjustable sling is positioned at the center-of-gravity along the edge of the mirror so there will never be astigmatism visible in the eyepiece when viewing at low altitudes (which is, again, made easier by the crescent bearings and excellent scope balance).

## Finishing Touches

A cursory Google search on "boundary layer fans" reveals that, among the involved discussions, there is no doubt of their benefit. Detailed analyses now seem to focus on "pushing air" or "pulling air" as the method to best remove the thin parabolic pool of warm air from the primary.

For the 16-inch Dob, NMT employs three fans in a "push" (air into the mirror cell) direction to promote mirror cooling and air circulation (**Image 6 and Image 7**). The nice touch here to the fan selection is the inclusion of a potentiometer as standard on all NMT scopes, allowing one to give the mirror "full blast" while the sun sets and then to dial the fan speed down to levels that keep the air flowing but allow for sta-

ble viewing.

In my own case, I generally keep the fans on at their lowest speed throughout an observing session – any slight vibration from the fans or waste heat from the potentiometer is negligible compared to the lost crispness of a globular cluster as the primary pools another pocket of warm air. When and how much to use the fans is ultimately up to the observer to decide based on weather conditions, transparency, and the time between setup and first object, but having all the shades of grey between on and off does improve ones odds of finding that perfect combination for such a big scope (and I would urge others limited to on/off switches to place a potentiometer between their battery and fans to see for themselves the difference).

Hooks for counterweights are included as finishing touches on the mirror box for those with extra-heavy eyepiece tastes. My test of smooth motion and balance was performed using a Tele Vue 26-mm Nagler with a 2x Tele Vue Barlow (because the best should be tested with the best). Even at just-off horizontal and with no additional counterweights, the 16-inch scope doesn't budge.

**Image 6 - The three boundary layer fans and counterweight holders; placement of the potentiometer and on/off switch.**

## Secondary Cage

In several of the "easy-as-that" YouTube videos (www.youtube.com/user/NewMoonTelescopes) NMT has put together to explain the assembly and disassembly procedure of their collapsible truss design, one finds that the secondary cage serves one additional function beyond the obvious placement of the secondary cage above the primary.

The secondary cage (**Image 8**) becomes a constraint for the collapsible truss assembly that separates the truss mounts perfectly for the mirror box – the truss cannot collapse in on itself due to its anchoring by the secondary cage and the truss mounts do not separate beyond the positions of the finger screws on the mirror box.

Furthermore, the secondary cage/ truss assembly is stable enough that it can rest on a flat surface by itself, making its own assembly easy with a little practice. NMT recommends this secondary cage/truss assembly-first procedure for 18-inch and larger scopes because the assembly then requires no ladders to complete. I think it an excellent way to put the 16-inch together as well.

The woodwork on the secondary cage is just as meticulous as on the mirror box, complete with Kydex lining and a mounted Telrad that doubles as a battery holder for the optional secondary heater (one of the real nice touches on the scope

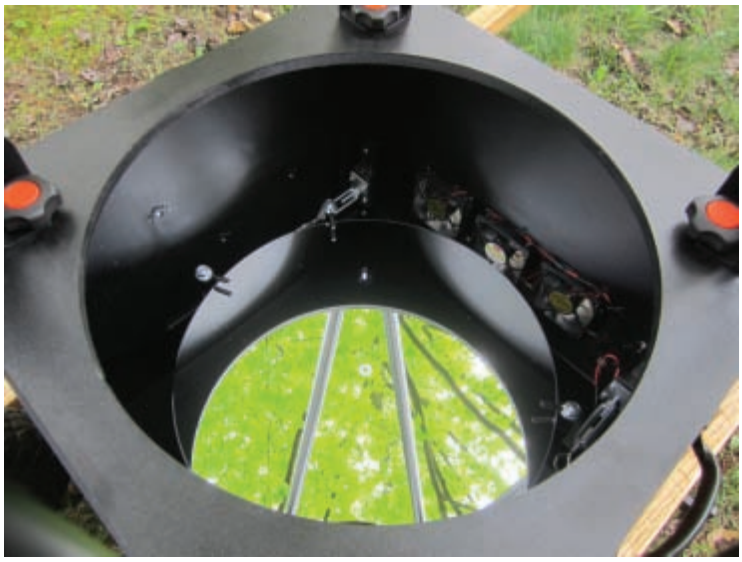

Image 7 - Interior view of the mirror cell and mirror supports, boundary layer fans, and interior matte black finish.


Image 8 - Secondary cage, showing the MoonLite dual-speed focuser, NMT plaque, and added finder scope.

that efficiently uses free space in the components and keeps one from running power up the trusses (**Image 9**).

## Secondary Cage Hardware

The standard complement of the secondary cage includes an AstroSystems spider with tool-less collimation via knurled thumb screws (**Image 10**), Telrad, Antares Optics 1/20th-wave secondary mirror (from nearby Rochester, NY), and MoonLite dual-speed focuser.

The secondary mirror and MoonLite selection are again examples of NMT's decision to incorporate high-end components as part of the design and not to skimp anywhere in the scope. In the case of the MoonLite focuser, its smooth action is all

Image 9 - Optional secondary-heater switch, with 9V battery hidden in the Telrad.

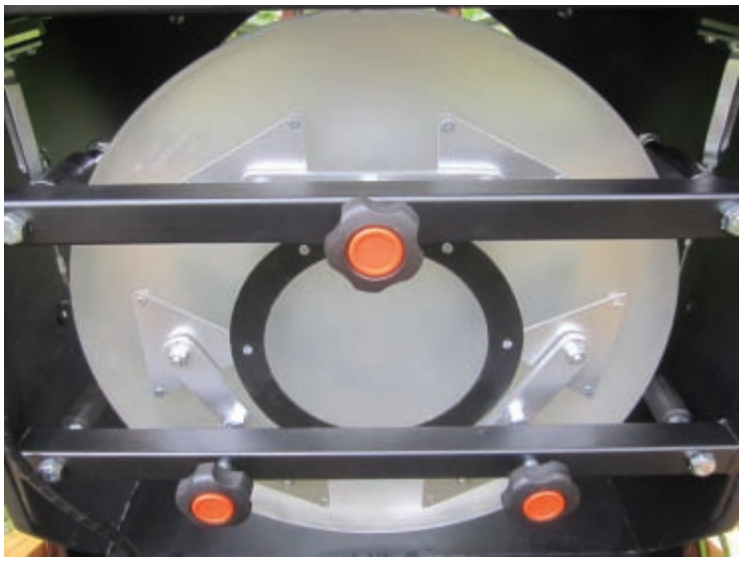

Image 10 - View of the inside of the secondary cage, showing collimating thumb screws and Kydex lining.

the more obvious when tested against most any other focuser at a Dob gathering. They are simply exceptional focusers.

## Collapsible Truss Design

The truss discussions at the NEAF booth fell into three categories: (1) That's a great idea! (2) I thought about that but never tried it. (3) I did something kinda like it, but I like how you did (something) better. Bringing the collapsible truss design to fruition is NMT and Ryan's real novel contribution back to the larger Dobsonian community, a point made clear by long discussions of his design and production details at the NEAF booth.

The benefits of the collapsible truss design as implemented by NMT are manifold. The truss assembly itself screws into the secondary cage and mirror box as a single unit of equal-length truss rods: (a) All four mount positions are identical; (b) There is no variation in the lengths of certain trusses due to variations in the way separate-pole trusses are placed into split blocks (or similar designs). The secondary cage/mirror box separation is always the same at all connection points every time. The result is an assembly that requires little collimation. The collapsible truss design also allows one to set up the scope in the reverse manner of a separate-truss design (**Image 11**).

Here, the secondary cage can be assembled on top of the flared-open truss first at a comfortable height for most observers. The secondary cage then acts as a restraint on the truss flexibility, allowing one to pick up the entire secondary-cage/truss assembly, place it over the screws on the mirror box, then let the whole truss rest stably on the mirror box as you tighten the finger screws at each position.

The disassembly works in the exact reverse, allowing one to close up the mirror box (and cover the mirror) before disassembling the secondary cage from the trusses. Again, this is the recommended procedure for the 18-inch and larger scopes, but I find it just as practical for the 16-inch. The trusses themselves are aluminum, powder-coated to a matte black (for wear resistance and to further darken what the shroud already covers), and with no sharp edges, while the connectors are all extra-large finger screws for those frosty 2 a.m. "I can't feel a thing" disassembly sprints (**Image 12**).

Image 11 - The secondary cage/truss assembly and mirror/rocker box in the middle of a secondary/truss-first assembly. The lightweight secondary/truss assembly is picked up, oriented, and placed on top of the mirror box.

The result is a scope that can go from separate components to ready-and-shrouded-for-observing in under two minutes (as demonstrated in the Youtube videos).

## Lightholder-Equipped

I had no doubt about the quality of the woodwork and components Ryan selected for NMT #1, which made it easy for me to choose to buy the absolute best mirror I could find for my only-once Dob. Just as I have seen many an amateur astronomer start with seemingly decent eyepieces, then eventually sell and buy their way up to Tele Vue (my personal bias, anyway), I have heard too many stories of observers with primary mirrors that eventually have their faults found out over the course of many observing sessions (the primary mirrors, that is). The solution, while not cheap, is simple – start with the best you can get and never, ever, find yourself regretting an "intermediate" purchase when you go to finally take the plunge on a high-quality

Image 12 - View of the secondary cage thumb-screw mounting and top of the collapsible truss.

Image 13 - This scope is "Lightholder-equipped" (linear bearing also shown at upper-left).

primary.

From the short list of primary mirror vendors Ryan originally recommended, I went with a 12.5-inch F/4.89 Lightholder because the price of the mirror for its quality was quite competitive with other high-end vendors (and, frankly, John Lightholder is as meticulous with his testing and provided paperwork as he is a real fun guy to exchange emails with). The mirror alone cost more than many of the major vendors are currently charging for complete-and-shipped 12-inch Dobsonian telescopes. The reason is simple – it is absolutely worth it.

The first group outing/observing gauntlet of NMT #1 at Darling Hill Observatory in Tully, NY was a complete jaw-dropper, with the 12.5-inch mirror and Antares Optics secondary outperforming present 16-inch scopes in terms of image clarify, definition, and overall brightness.

NMT's 16-inch f/4.5 Dob is, simply, that much better than the 12.5-inch, gathering 80 percent more light on a still perfectly figured mirror (**Image 13**). To have the spiral arms in M81 stand out, to see Stephan's Quintet without need of averted vision, to see planetary nebula take on richer colors and to have their central star visible, and to pick out the occasional globular cluster in the Andromeda Galaxy on a transparent CNY night all thoroughly convince one that the only rational corners one should cut in the purchase of a 16-inch Dob are those of the box joints.

That said, NMT allows the customer to select their mirrors or use their own in rebuilds. As a general endorsement of Lightholder mirrors, I cannot say enough about just how good Lightholder primaries are, and I am very pleased to know that Ryan opted to complement his expert woodworking skills with premium optics to produce a truly remarkable NMT product.

## Closing Thoughts

The final cost of the 16-inch f/4.5 as tested and inspected is currently $5,998.00, complete with more features that come standard in NMT scopes than some premium Dobs offer for comparable prices. When considering the quality of the build and the choice of components, I would have no hesitation in recommending that the dedicated amateur astronomer and other only-once purchasers like myself consider the New Moon Telescope 16-inch f/4.5 Dob as their lifetime gateway to the Nighttime Sky. Fellow amateur astronomers will appreciate not needing (or wanting) to bring their scopes to your observing sessions. ATT