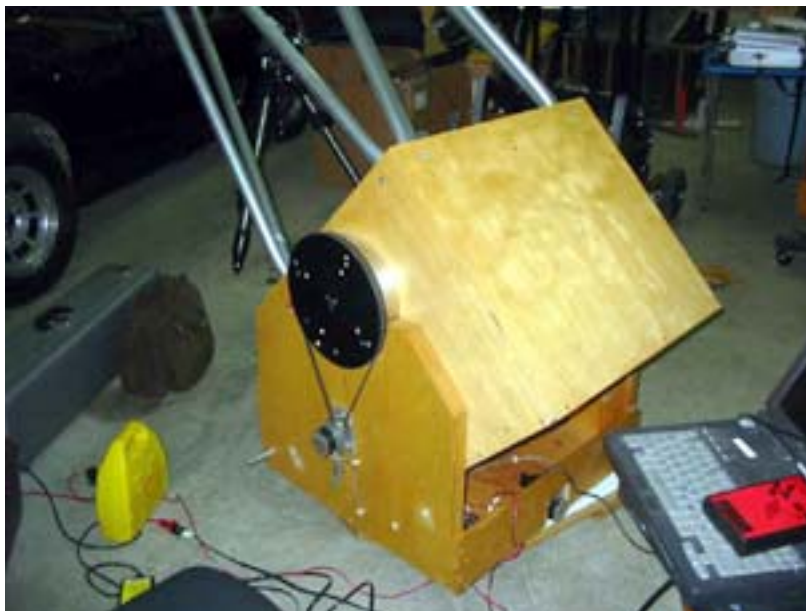# DOB DRIVER II by TECH2000
by John Crilly click to email author

Introduction

Dobsonian-mounted Newtonian reflector telescopes (hereafter referred to as Dobsonians) are more popular than ever. There are several recent entries into the ranks of producers of premium, medium to large truss Dobsonians. There's the recent influx of imported tube Dobsonians of medium aperture. ATM's are using ever more innovative designs for open-tube structures to replace truss structures.

Users of Dobsonian telescope mounts are becoming more demanding of their systems. More and more, the Dobsonian mount is veering away from Mr. Dobson's original concept of the cheapest possible but still functional telescope system. Extravagant optics, oversized elevation bearings, elegant structural designs, exotic materials or rollers in the azimuth bearings, digital setting circles, and even GoTo and tracking capabilities are becoming relatively common.

The oldest and most common scheme for adding tracking capabilities to a Dobsonian mount is the equatorial platform. These platforms are slightly tilted plates mounted on offset bearings which permit them to swivel through an arc appropriate to cause the telescope to move equatorially. The Dobsonian mount is simply placed on top of the platform. The advantages to such platforms include the fact that they provide automated sidereal tracking with no modifications to the mount itself. They also eliminate field rotation, making them suitable for imaging

at longer exposures. Disadvantages include the fact that they necessarily add some height to the system, the need to reset the platform after an hour or so, and the need to accurately adjust for latitude and North. They also constitute one more item to load, unload, set up, and tear down for field use. Typical costs for these platforms begin at around $1000.
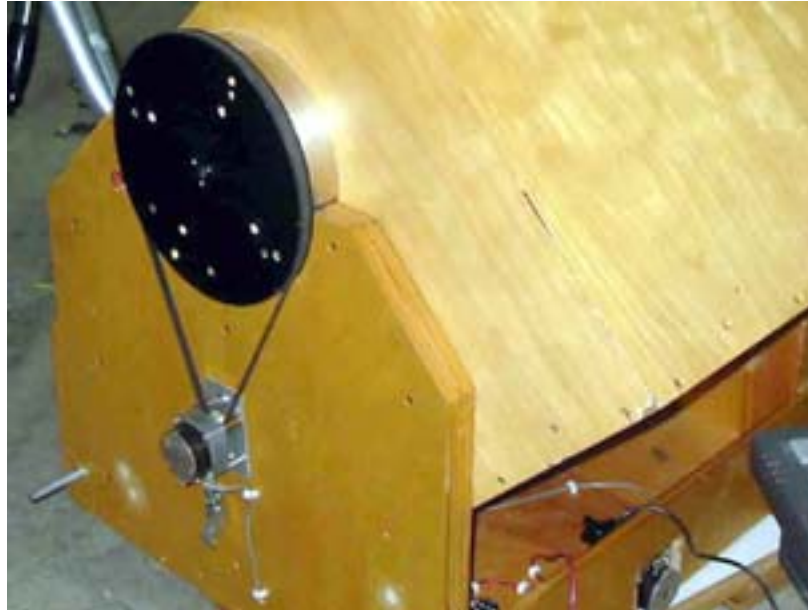
Another option with increasing popularity is to install motors on both axes with computer control. The capabilities of these can range from simple tracking to full GoTo capabilities. The most popular is probably the ServoCat, which is offered as a factory option on several premium Dobsonian packages. It can also be retrofitted to existing telescopes. It has the advantage of interfacing with standard DSC setups, such as the Argo Navis, to provide full GoTo operation using readily available and familiar encoders and controllers. Cost is about $2000 for the complete setup. Another, less expensive (and thus intriguing to me) system is offered by Tech2000 and is called the Dob Driver II. Either setup is going to be affected by field rotation, of course. Advantages of onboard motors include no additional hardware to set up, little added weight, and no added height. There's also a cool factor involved in watching a medium to large Dobsonian moving by itself.

The Dob Driver II

The Dob Driver II is unique in several ways. It can be supplied with a variety of well-engineered drive schemes, to fit whatever mount is to be converted. It is the only system I've seen which can provide tracking with no alignment whatever; with the telescope pointed at a desired object, a brief training session tells the controller just how the object is moving and the drives will then track that object. One interesting advantage of this scheme is that it isn't limited to sidereal tracking; comets or other objects with their own apparent motion are fair game. It also needs no external computer or controller to provide this function, the computing capabilities for this are in the supplied hand controller. This basic system sells for approximately $700 with controller, wiring harness, motors & drive hardware. Addition of the Roboscope option, including software, adds the capability of GoTo operation but requires an external PC or laptop. Autoguiding capabilities and higher resolution steppers can also be added as an option.

I installed two of these systems this year, one on my older (and very heavy) 20"
F/4 Sky Designs truss Dobsonian and the other on my later Starsplitter 15" F/5.
Both of my units include the APC-Link option necessary for GoTo operation with
an outboard PC or laptop. One of them also has the Autoguide option. I found the
supplied instructions to be very clear. They included a discussion of the various
drive systems and the factors to be considered in choosing and installing each
one. Both went in fairly quickly, with a minimum of woodworking or modifications
to the existing mounts. The manual spells out the simple tools required: Flat and
Phillips #2 screwdrivers, scroll saw, twist drills in 1/16", 3/32", 1/8", 5/32", and 3"
and boring bits of 2" and 1". I found that a 2" boring but was also helpful when
installing the supplied roller assemblies, and a saber saw was also used. The
systems as supplied include operation and installation manuals, templates,
handbox with wiring harness, barrier terminal strip with legend, and two drives
with appropriate hardware. Both have proved to be very effective in adding
tracking capabilities to their respective mounts.

The Dob Driver II adds about five (5) pounds to the total weight of the telescope. It operates from a nominal 12VDC; the usual range of gel cells work well. With no motors operating, the current draw is approximately 175mA, with both motors slewing it's around 600mA, and it draws about 330mA while tracking. Tech2000 suggests as a rule of thumb that a battery will operate the Dob Driver II for approximately 3 times its Amp-hour rating in hours. Step size with standard steppers and 20" drive bearings is about 1.8 arc-seconds. The maximum slew speed is about 4 to 7 degrees/second; this varies, of course, with the diameters of the drive circles.

Due to my reluctance to deal with laptops, extra cables dangling, and extra batteries I have not done much with the GoTo capabilities, although both of mine do have that option installed. Brief experiments convinced me that the scheme can work, and I look forward to implementing it on at least one of my Dobsonians soon. I'll be adding a laptop platform to the rocker box of the 20@ so the laptop will become part of the moving system and thus eliminate cable-dragging; after that is achieved I'll report on my success or lack thereof with the GoTo setup.

Installation

For both scopes, I chose the surface drive scheme for azimuth. This involves replacing the teflon pads on which the rocker box rides with two rollers supplied with the kit to reduce friction.

These are installed a little less than 120 degrees apart, either side of the center front of the rocker box bottom. Then the motor is mounted to the rocker box rear center so that a knurled wheel (about 2" diameter, 2" width) drives against the top of the ground board to rotate the rocker box. This requires notching out the bottom and back panel of the rocker box.

Depending on the distance from the edge of the rocker box to the edge of the ground board, the motor can be installed either to the edge of the ground board

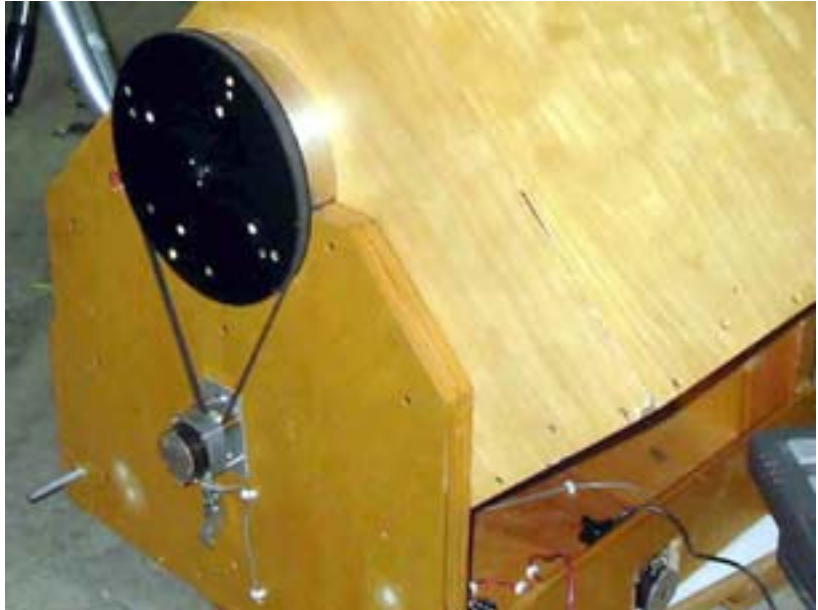or to the rear panel of the rocker box.

The roller locations are chosen to ride in a circle on the ground board top surface slightly smaller in diameter than the one in which the drive motor rides, so the rollers don't use the same area of the ground boards top surface that the drive motor uses. Templates are provided with the kit to ensure proper placement of these parts. Each roller is held in place by two wood screws and spacers are

used to position the rollers at the same height as the drive wheel. Tech2000 recommends facing the top surface of the ground board with a laminate such as Formica to provide a smooth, consistent surface against which to drive; I did so. There is provided a long Teflon pad, the center of which can be pushed down by a bolt through the bottom of the rocker box. When pushed down this pad contacts the ground board and causes the drive wheel to lift. In this mode, the mount can be pushed around manually as though the drive were not there. If DSCs are installed, this doesn't affect alignment - but if the Roboscope GoTo setup is in use, alignment information will be lost. The Roboscope system relies on knowing what the stepper motors have been up to.

Tech2000 also offers a rim drive for azimuth, which drives on the outer diameter of a round ground board. I considered this for the Starsplitter since it has a circular ground board, but had no easy way to face the perimeter into a perfect circle. The azimuth rim drive also includes an adjustable slip clutch which makes it unnecessary to disengage the drive for manual motion of the telescope; this clutch looks similar to that used in the declination tangent drive add ons for the Meade LX series.

The Sky Designs 20" has old-fashioned, small (10" diameter) aluminum elevation bearings. Tech2000 recommends a belt and pulley drive scheme for this setup, and that"s what I chose.

A supplied pulley is mounted to and concentric with one of the elevation bearings. The drive motor is mounted to the outside of the rocker box at a distance which permits the supplied belt to achieve proper tension.
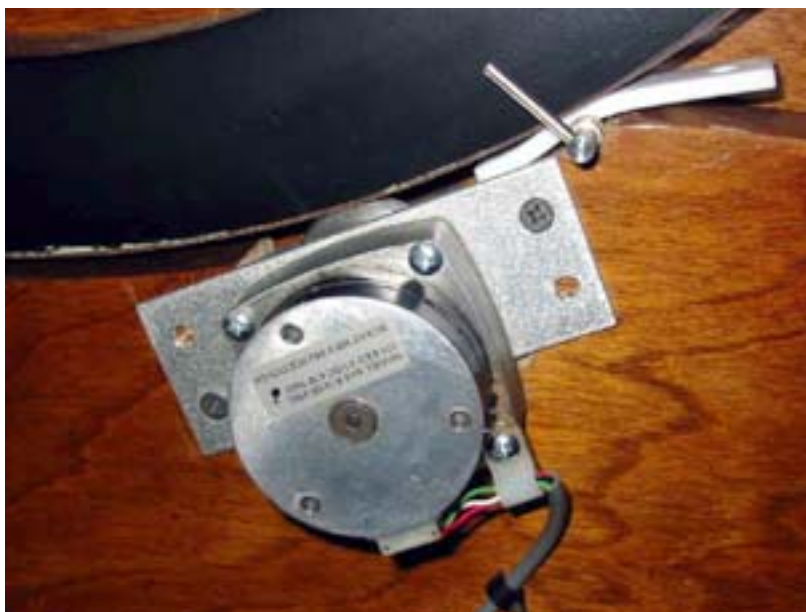

A spring clutch is provided which permits relaxing the belt so manual motion is possible. Again, this won't affect DSCs but will cause Roboscope to lose position information. Supplied rollers are used to replace one or more of the usual Teflon pads to permit the elevation motion to be more free. Due to the weight of my system and the small elevation bearings I replaced all the Teflon pads with rollers on this one. To remove the mirror box, it is necessary to first release the spring

clutch and remove the drive belt.

I mounted the supplied pulley to one of the existing aluminum elevation bearings by drilling and tapping (#8-32) holes into the side of the existing bearing and drilling holes in the supplied pulley to match. Four machine screws attach the pulley. I mounted the elevation drive motor and spring clutch lever to the outside of the rocker box with woodscrews. I removed the other three Teflon pads and replaced them with the supplied rollers. This involved using the 1" boring bit to create hollows in the rocker box cutouts where the Teflon pads had been and using two wood screws per roller assembly to mount them. The modification is invisible when the mirror box is in place; the outside surface of the rocker box is undisturbed.

The Starsplitter is a more modern design, with 20" radius elevation bearings. These larger bearings permit rim drive. In this scheme, the drive motor is placed so that a knurled wheel (similar to that on the azimuth surface drive) replaces one of the existing Teflon pads and drives the bearing segment .

This requires notching out the side of the rocker box. Supplied rollers can be used to replace one or more of the other Teflon pads, but I found that everything worked great with the other stock pads in place (though I did move them toward the center a bit). I really prefer this setup, and will convert the Sky Designs to rim drive as soon as I change it over to modern, large-diameter elevation bearings. The manual recommends removing whatever surface is installed on the elevation

bearing to eliminate vibrations from driving on its pebbly surface, but I found this to be unnecessary on mine. To disengage the drive, an additional Teflon pad is supplied with a rotating toggle underneath it, permitting it to be raised up into contact with the elevation bearing. This lifts the bearing away from the drive wheel. To remove the mirror box, nothing needs to be done; the mirror box is simply lifted out of the rocker box as before. There is a Rim-2 elevation drive also available, which uses a slip clutch similar to that of the azimuth rim drive; I chose to use the original setup to avoid clutch adjustments or slipping problems.

I removed one of the Teflon pads on which the elevation bearing rides, and notched the side of the rocker box so the drive motor could be mounted with the rim of the drive wheel at the same height the pad had been. This way, the mirror box drops into place just as before, and the geometry of the system is undisturbed. I mounted the drive motor to the rocker box side with wood screws and tried it; I found it unnecessary to replace any other pads.

Given my lack of woodworking tools and skills, I tried to shortcut the installations at first, and had mixed results during initial testing. I then tore both mounts down and took the time to follow the directions more completely, and was rewarded with great results despite using the same tools and ability (or lack thereof). This system can be installed with a bare minimum of tools and talent. As the photos show, some room has been left for fine tuning the cosmetics of this installation. The first priority will be some sort of shields or housings to cover the motors so they aren't damaged by striking objects while in the back of the truck.

Suggestions and Cautions

I have some suggestions for folks considering such an installation. Initial attempts to use these telescopes with my usual external gel cells caused some frustration in the dark, with cables dragging around as the scope rotated. There is no tripod under which the battery can be stored! I ended up installing gel cell batteries inside (15") or onto (20") the rocker boxes holding them in place with Velcro strips. I used 6.5 Amp hour gel cells because I also power fans with them but a smaller battery would run only the Dob Driver II for quite a while. Placing the battery either within or on the rocker box makes things work much better. I had the same frustration with a laptop and the communication and power cables for it. As stated earlier, this can be eliminated by having the laptop mounted to the rocker box and I will arrange this before further Roboscope experimentation.

I already know that both of these rocker box/mirror box combinations are square and remain true as they move, because both work well with digital setting circles. Some Dobsonian mounts may be less square or less stable. This would reduce the effectiveness of the tracking function, and would probably make the GoTo function fairly useless. A Dobsonian mount should be evaluated for these characteristics, and modified or upgraded to improve them if necessary before this installation is attempted.

Operation

The handbox is very simple to operate, having only four buttons and a few LEDs plus a seven segment display to watch. It can be operated in several modes; PAN, TRACK, GUIDE, SEEK, BLASH, MAXSPD, CONFIG, AND DSC.

Mode selection is an easy one-hand operation. The digital display shows the step rate in use at a given time. The first routine to be used is CONFIG; this is used to set motor direction and some other one-time initial selections. Next is MAXSPD, which sets the maximum slew rate. After selecting this mode, motion controls are held down one at a time while the slew speed ramps up automatically. When the desired slew rate is achieved, or it stalls because the maximum is too fast with the effective reduction rate in that particular setup, simply release the button. That will be stored as the maximum slew rate for that axis in that direction. It won't be necessary to do this again unless a mechanical change is made to the system. The next setup step is BLASH, or backlash. Simply enter that mode and use the simple routine to tell the system how much backlash is present.

There's a PAN mode; this permits the motors to be used to slew the telescope to the desired position. In this mode, pressing a direction button causes the drive to begin slewing the telescope at a slow rate, increasing gradually to the maximum slew rate set above. There's a SEEK mode that's very powerful. Move the telescope to point to the area of the object being sought. Enter SEEK and set the field of view size to fit the eyepiece in use with a simple built-in routine and off it goes in a spiral search. Press a direction button when the object swings into view and the drives stop.

Two other modes are displayed on the front panel. One, GUIDE@, may be used with an autoguider if that option is installed in the Dob Driver II handbox. It can also be used for manual guiding using an off-axis guider or a guidescope. The other, ADSC@ is for a proposed future interface with a DSC controller. This would be a great addition, as it would eliminate the need for a laptop to provide GoTo operation. I hope this is implemented soon - but it's been waiting for years already so I won't hold my breath.

The mode for which the whole thing was installed, though, is TRACK. Point the telescope at a desired object, enter track mode, and use the direction buttons to keep the object centered. After 15 seconds or so, you'll notice that the buttons aren't necessary; it's tracking! Subsequent minor corrections at longer and longer intervals can further refine the tracking. This makes my Dobsonians perfect for their intended mission. I can go to a public viewing session, center an object, set up tracking, and let the public take turns viewing the object without constantly interrupting them to recenter. I can't picture myself going for long without this capability again.

Conclusions

This is a very handy, functional, and easy to install system. It adds tracking capabilities to virtually any Dobsonian mount at a reasonable cost and effort expenditure. The tracking alone has justified the effort and expense for me; further trials of the GoTo and guiding capabilities may prove it to have even more functionality than I have already used.

Positives about the Dob Driver II

- no alignment or external hardware required for tracking
- Flexible tracking capability, not just sidereal
- simple, intuitive handbox
- economical (compared to ServoCat and other systems)
- adaptable to various mount configurations
- relatively simple to retrofit to an existing mount
- instructions are complete and easy to follow
- adds no height and little weight
- Great support available from the Tech2000 folks

Negatives about the Dob Driver II

- requires a laptop or PC rather than just DSC's for GoTo
- Website info is slim (but supplied documentation is excellent)
- It has no way to avoid field rotation for long exposure imaging

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Disclaimer

The Dob Driver II setups used in these installations were acquired in part by retail purchase from Tech2000

> (http://homepages.accnorwalk.com/tddi/tech2000/)

and in part as used items from various vendors. I have no relationship with either Tech2000 or any other commercial enterprises mentioned in this article beyond that of being a satisfied customer.

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