Review of the Meade Lightbridge 16 inch Deluxe Dobsonian

(by Jan van Gastel)

Dutch version (Nederlandse versie)

This is a test report of a Meade 16 inch Lightbridge. The telescope looks very nice (photo 1). But what's more important is how it works. That's what this test is about.

Photo 1:assembled 16 inch Meade Lightbridge

Assumptions for testing
When someone buys a new telescope it should work well out of the box, without having to rebuild it to make it's basic functions work well. Which means that:

1. Mechanisms for movement in altitude and azimuth, for collimation and focusing have to be good enough to perform their task well, if applied properly (category I, table 1[1]).

2. The telescope will operate well without difficulties (category II in tabel 1), including assembling and disassembling the telescope, taking it in and out of the house (or garage or whatever place the telescope is stored) and, if necessary, transporting it to a dark location.

3. The telescope is well balanced or can be balanced easily, that it has good position stability, and a position-independent collimation, at least within the tolerances for that telescope (category III in tabel 1).

4. The optics are capable of delivering good views and are at least within the specifications provided by the factory. Good baffling and good cooling of the primary mirror also belongs to this category (category III, table 1).

The four assumptions mentioned above and the corresponding categories in table 1 are not independent of each other, but rather approach the telescope from different points of view, in order to allow a good judgment of the telescope. The figures in table 1 are on a 1 to10 scale.

Assembling the rockerbox and the ground board
The ten large screws used to assemble the rockerbox fit tightly in pre-drilled holes. Assembling of the rockerbox and ground board combination is an easy, one man job. Between the round wooden bottom of the rockerbox and the ground board, a combination of three metal 'plates' must be placed: two closed round metal plates and in between one with lots of small roller bearings. Closer to the edge of the ground board are three teflon pads. Fastening or loosening a central bolt that traverses the ground board and bottom plate of rocker box, can control the friction between rocker and ground board.

Quality of the mount
The rockerbox and ground board are made of 18 mm thick *particle board*. In my opinion, given the large and heavy (58 kilo's) telescope, 18 mm is too thin. And it would have been much better to use better material, for instance plywood, instead of particle board. Movement in azimuth can exert large forces on the sides of the rocker and damage of the mount in the long run is not unlikely, especially not if the mount has to be carried in and out of its storing place before and after observing. For instance, the screws might eventually be pulled out of the particle board. Observers (without a very large car) who want to transport the telescope to a dark side, will have to assemble and disassemble the rocker and ground board before and after each observing session. I am sure the screws will not stick properly in the particle board any more, after screwing and unscrewing a couple of times[2]. Furthermore, because of the large, round rocker bottom and ground board, it is very difficult to move the assembled rockerbox-ground board combination through a normal door.

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[1] To be found at the end of the review
[2] And see also: http://www.cloudynights.com/item.php?item_id=2197

Assembling the telescope

Placing the relatively heavy mirror box into the rocker box, putting the trusses in place and mounting the secondary cage on top of the trusses is not too difficult and can be done by one person[3]. In the dark a lamp will be needed to see what one is doing, for instance when fastening the secondary cage and making sure it is placed on the trusses well (the holes in the case and in the trusses have to coincide). Total assembling time takes no more then about 3-4 minutes.

Balance

The telescope, itself top-heavy without any finder, shroud or eyepiece, moves downward by itself already with a very small eyepiece in the focuser, or with the red dot finder mounted. The telescope is severely disbalanced when a shroud and a magnifying finder are added.

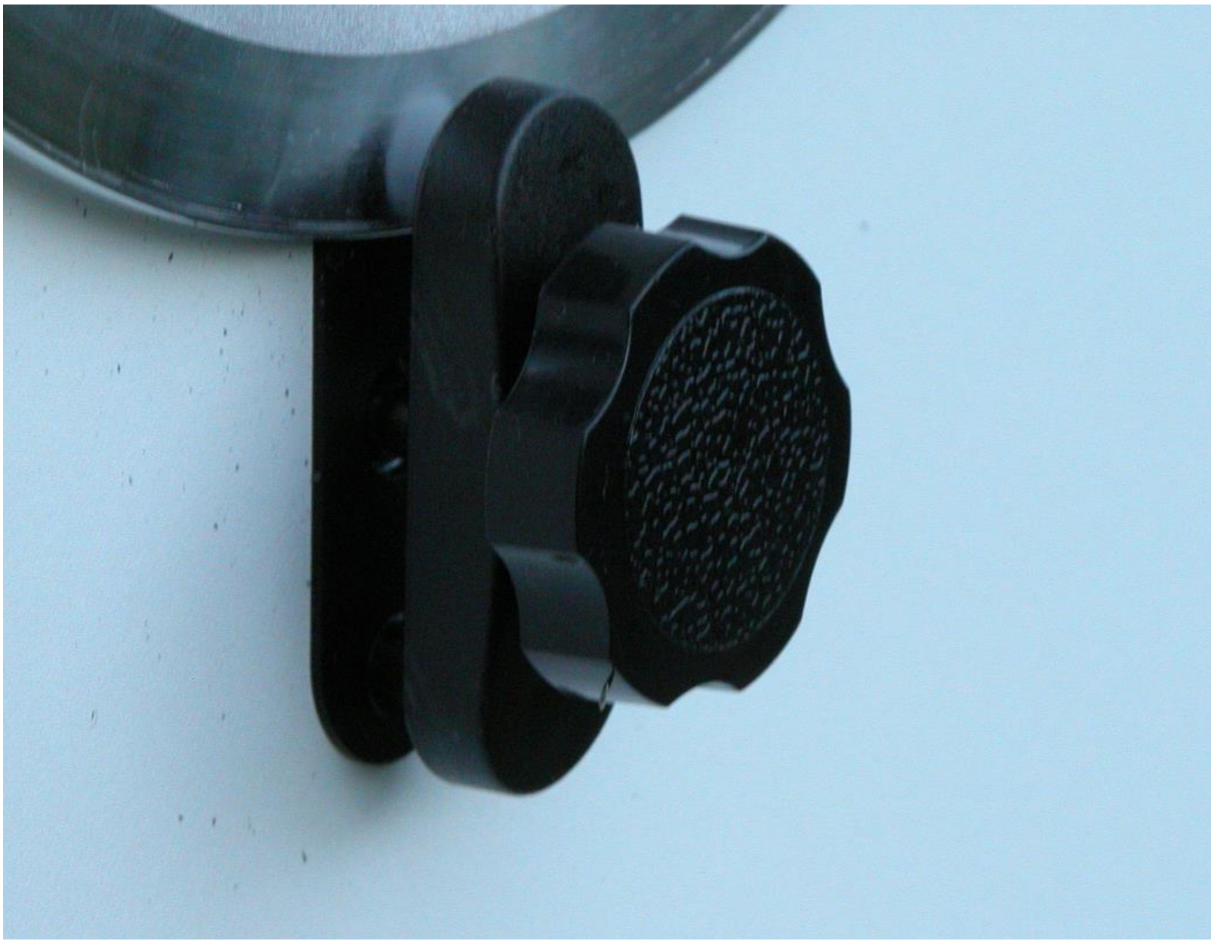

Photo 2: friction mechanism for balance control

To control the balance a tunable friction mechanism is placed against one of the aluminum altitude bearings (photo 2). This friction mechanism does work, but affects the smooth movement of the telescope extremely negatively, because of the very large imbalance of the telescope. This friction mechanism also strongly magnifies the position (in)stability in altitude (see below). A real balance system, with a contra weight on a rail (or something like that) would have worked much better, without amplifying the position instability problem.

[3] Somewhere on the internet I read two persons were needed to do the job, so your mileage may vary

Movement in azimuth
The ease of movement in azimuth can be controlled by tightening or loosening a central bolt that traverses the bottom of the rocker box and the ground board, but even when tightened as tight as possible by hand, the friction still remains too low and movement is too easy[4]. This causes the telescope to overshoot an object too easily. If one is not very careful when putting another eyepiece into the focuser after having centered an object, the object will disappear from the FOV because the telescope has been moved out of position. This is a frustrating experience. The metal azimuth bearings may operate nicely in the context of an installed go-to system (which I didn't have), but for a hand-moved Dobsonian, the movements are way too easy. In addition, the metal plates make the telescope mount extra heavy.

Movement in altitude
The altitude bearings, 8 inch diameter aluminum wheels, do not run on teflon pads like in most Dobsonians, but on felt strips. When pointing the telescope up- or downward, the altitude bearing wheels are pushed a little into the front or back felt strips. When letting the OTA go when the object is in the FOV, it sinks back to its center position between the felt strips, causing the object to disappear from the FOV again. This is especially the case when moving the scope upward, in the direction against the imbalance. For instance, to center a star a little higher in altitude than the actual position of the telescope, while using a magnification of 200 x or more, the scope has to be pushed past the star. When one lets the scope go, the star appears somewhere in the FOV or shoots past it again, to the opposite side. This 'game' has to be repeated until the star is reasonably centered. The higher the magnification, the more frustrating this is, and it is made even more frustrating by the above-mentioned problem in the azimuth movement. This position instability also makes focusing difficult at high magnifications, because of unintended movements of the telescope[5].

The secondary mirror and the baffling
The 3.5 inch minor axis secondary results in a 83% illumination of the edge of the FOV, of a 31 mm 2 inch Nagler eyepiece, which is good. The upper edge of the secondary should have been blackened to prevent it to reflect light into the FOV. It would also have been nice if a secondary mirror dew prevention had been implemented in this 'DeLuxe' telescope. During humid nights, the secondary will certainly dew up.

Looking through the empty focuser, positioning ones eye at the FOV position, lots of 'air' can be seen above and below the secondary cage. Below the secondary cage, one might assume, this problem would be taken care of by the (included) shroud, but this is not the case. Without extra adjustments, a normal shroud doesn't work well on a six truss Dobsonian, because it will fall into the light path. The fact that the included shroud is too wide for this scope makes this problem even worse[6]. Furthermore, to prevent the upper side of the secondary case from letting stray light enter the FOV, a baffle should have been included. Using such a baffle is recommended in the manual, but in my opinion, it should have been included, because without one, the scope doesn't deliver as well as it is meant to do.

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[4] See also: http://stargazerslounge.com/equipment-reviews/75334-meade-lightbridge-16-first-light.html
[5] See also: http://www.cloudynights.com/item.php?item_id=2070
[6] See for instance also: http://stargazerslounge.com/equipment-reviews/75334-meade-lightbridge-16-first-light.html

The focuser
This Lightbridge comes with a Crayford focuser (photo 3), good for 2 inch and 1.25 inch eyepieces. It has no backlash and is double speed, an unreduced and a 1:10 reduced speed, which makes accurate focusing easy. To hold the eyepieces and collimation tools well, the focuser has a tightening ring.


Photo 3: de focuser

Collimation
According to the manual[7] the scope can be collimated accurately enough by eye only, which is not true for an f/4.5 telescope. A star test is recommended to check the collimation. Not a good advice in this case, because with a star test only the collimation of the primary mirror can be checked, not the collimation of the secondary mirror.

Collimating the secondary mirror
The secondary was well centered in de focuser (as shown in a sight tube) and the tilt of the secondary was not far off. Using the three small collimation bolts (photo 4) a laser spot can be centered in the primary mirror center spot, but it is not very easy to accomplish this, because the three bolts are not easy to turn. When turning one of the bolts, the whole secondary-

[7] Besides the wrong information about collimation, other information in the manual could also be very much improved. It contains, for instance, no information at all about dismounting the primary mirror, about the mirror cell and about cleaning the mirror.

secondary mount assembly moves and the laser spot has to be moved past the center spot, bouncing back to the opposite side of the primary center spot when letting the tension on the bolt go.

Photo 4: the secondary mirror and secondary mount with the three collimation bolts

Collimating the primary mirror

To collimate the primary, the backside of the mirror cell has six large knobs (photo 5), three black ones and three white ones. The black knobs, with springs to keep the cell in place, are used to actually collimate the primary and the whites are fastening knobs.

Photo 5: Rear view of mirror cell with collimation mechanism and cooling fan

All knobs move smoothly, without the need to use much force. I prefer collimation systems without extra fastening knobs, but this system works nicely and without any problem on this telescope.

Collimation stability

Once collimated, the telescope does *not* keep collimation when moved in altitude[8]. Putting a laser or a cheshire in the focuser can show this. Most critical is the movement as shown by the cheshire. The amount of movement of the center spot in the cheshire is 2-4 millimeters, which is way too much for an f/4.5 system.

[8] Not caused by movement of collimation tools inside the focuser

Cooling the primary mirror
The primary is cooled by a large fan (photo 5) blowing against the bottom of the mirror. The fan is very silent and works without noticeable vibrations. The 12 V fan is powered by 8 1.5 volt batteries, in a battery pack.

The optics
The optics are of *reasonable good* quality. For instance, stars in star clusters, focus reasonably well and do not show signs of deformation at the center of the FOV. The telescope is more affected by seeing then my 12 inch (both primary and secondary mirror have a certified 1/8 λ wavefront and are very smooth) and 20 inch telescope, under equal observing conditions[9] and equal magnifications. For instance, the F-star in the Trapezium (Orion nebula) was less well visible with the Lightbridge than with the 12 and 20 inch telescopes. In the Lightbridge it even became invisible a couple of times in moments of bad seeing, which was not the case in the other two telescopes.

Out of focus stars (magnifications up to 520 x) did not show astigmatism, pinching, zonal aberrations or turned edge. Diffraction rings on both sides of focus were clearly visible (in moments of good seeing), round and didn't show obvious deformations. Equally far from focus, the secondary shadow is larger outside of focus then inside of focus, meaning the mirror is overcorrected. Using an artificial 33% obstruction (as described in Suiter 1995[10]), the focuser has to be racked in about twice as far, as it has to be racked out, to get the same size of the secondary shadow[11]. We didn't perform a bench test, so we can't give a quantitative quality judgment, but I think it's save to say that the quality of the optics approximately meets the often-used 'diffraction limited' criterion.

Conclusion
The telescope has good, mediocre and bad characteristics. The overall mean score (tabel 1) is 5.8, which is just a 'pass' when rounded up. However, looking at the overall mean is not the best way to judge the scope I think and potential buyers will have to weight the importance of the categories in table 1 for themselves. For me, category III would be the most important, if I was thinking about buying a 16 inch Lightbridge, because:

1. The instability of the collimation, in combination with the low collimation tolerance for an f/4.5 system, will result in optimal image quality only when pointing at or close to the position in which the telescope was collimated. To get optimal image quality further from that position, the telescope will have to be re-collimated. This will not be easy for positions higher then about 60°, because then it is difficult to reach for the collimation mechanism.

2. The bad position stability in azimuth and, even more important, in altitude, cause problems in pointing, in centering objects and in keeping objects centered in the FOV, especially when using medium and high magnifications. Keeping objects centered is important because of the small coma free field of an f/4.5 telescope. And, of equal

[9] The telescopes were used next to each other three times. Before starting to observe, the scopes had been outside for four hours with working fans, to get the mirrors at ambient temperature.
[10] H.R.Suiter (1995), Star Testing Astronomical Telescopes. A Manual for Optical Evaluation and Adjustment, Willmann-Bell inc., Richmond, Virginia.
[11] After repeated measurements we (three persons) arrived at a ratio of 1:1.8 to 1:2. For comparison: in my 12 incher the ratio is about 1:1.2.

importance, the position instability makes pointing and centering, a frequent necessity with a hand moved Dobsonian, very frustrating.

In user reviews on the internet en some astronomy forae, the above mentioned problems are often taken for granted, because of the price of the Lightbridge, as compared to the price of other large Dobsonians. And it’s true: the Lightbridge is not an expensive telescope. And with some rebuilding – examples can also be found on the internet - the Lightbridge can be made to work a lot better than it does now, out of the box[12]. But this does not alter the fact that the *out of the box telescope* is a mediocre to bad performer on – for a Dobsonian telescope – essential points. In my opinion, it would have been perfectly possible for Meade to make a much better large Dobsonian, for only a few dollars more.

[12] See for instance http://www.batchelors.net/personal/telescope/16-inch-meade-lightbridge-telescope.html and http://www.batchelors.net/personal/telescope/16-inch-meade-lightbridge-telescope.html

Tabel 1: summary of review Meade 16 inch Deluxe LightBridge

Topic	Score
I. Quality of Mount and control mechanisms	
1. Mount	6
2. Azimuth bearing mechanism and friction tuning mechanism	5
3. Altitude bearing mechanism	5
4. Balance tuning mechanism	4
5. Collimation mechanism of secondary	6
6. Collimation mechanism of primary mirror	7
7. Focuser	8
Mean score	**5.9**
II. Ease of control	
8. Assembling rockerbox and ground board	8
9. Manageability of mount	6
10. Placing the mirror box into the rockerbox	8
11. Mounting the trusses	8
12. Mounting the secondary cage	7
13. Object positioning in azimuth	5
14. Object positioning in altitude	3
15. Collimation of secondary	6
16. Collimation of primary	7
17. Focusing	5
Mean score	**6.3**
III. 'Overall' performance quality	
18. Optics (primary - secondary combination)	7
19. Cooling of primary	7
20. Baffling	5
21. Balance control	3
22. Azimuth position stability	5
23. Altitude position stability	3
24. collimation stability	4
Mean score	**4.9**
Overall mean score	**5.8**

Meaning of the figures in column 2:
8=good, 7=reasonably good, 6=pass, 5=no pass, 4=bad, 3=very bad.