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AUTOSTOPEM PRZEZ GALAKTYKĘ

ISS: JAK PRZETRWAĆ I NIE ZWARIOWAĆ?

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GWIEZDNY KALEJDOSKOP – ORION | WARSZTATY MŁODEGO ASTRONOMA
W ZAGADKOWYM ŚWIECIE GWIAZD | POCZĄTKI ASTRONOMII | SERIAL „MARS”
FINAŁ IV KONKURSU IM. HEŃKA KOWALEWSKIEGO FORUM ASTRONOMICZNEGO

WZIĄĆ BYKA ZA ROGI – TELESKOP TAURUS 16” TEST

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Damian Demendecki

TAURUS 400

Model: Taurus T400 F/4.5 Classic
taurustelescopes.com

It somehow happened that I still didn't know the owner of „Taurus" before. I did know his great telescopes, though. How great was my surprise when 'Astronomy', the biggest and most know Polish astronomical magazine asked me for doing small review of Taurus telescope for them. I was glad and I've immediately contacted Adam Salawa, the owner of the company, in order to arrange a meeting.

Damian, I brought to you Taurus – after couple of days he greeted me from the doorstep, as if he didn't beat those few hundred kilometers away from our places of residence. Completely as if we knew each other for longer than a few phone calls.

After the meal, coffee and a nice conversation, we brought the telescope home and there was a short presentation of setting it up, a few remarks and.... Adam from Taurus, just as soon as he appeared, disappeared behind the doors.

I became alone at home, impatiently starting to look at the new „acquisitions". From then on, big Taurus will stay with me for a couple of weeks. It is the end of November, behind the window the sky covered with a tight layer of clouds, what can I do.... We will see! Here we go – there is the review of all-Polish production Dobsonian telescope Taurus T400 Classic.

The telescope comes in three custom-made covers made of durable fabric „codura" with foam pads. In the long sleeve there are truss tubes, and in the characteristic „crescent" we can find altitude bearings, with a nice accent in the form of a separating insert. Finally, a large cylindrical case with the heart of the telescope, securely placed inside the rocker box and with a screwed-on upper cage.

The set also consists of an stiffening strut for altitude bearing in the form of aluminium pipe and a counterweight of 1 kg to be mounted on the bottom of the telescope. At the base of secondary mirror you will also find a mysterious box with a pair of wires and a sensor. It is a secondary mirror heating controller with two point temperature measurement, automatically adjusting the heating power to the difference in temperature between surrounding air and mirror substrate, great!

Rocker box, Dobsonian base

As the foundation of the whole structure in the Dobsonian telescope, its quality determines the accuracy and stability of functioning of virtually the whole telescope.

It is usually built in the form of a box with a central rotary axis and plain bearing. Teflon pads placed underneath the swivel bottom of the box are a support for it and at the same time enable smooth rotation of the box horizontally.

Against this background, Taurus's base is an exception. It does not resemble a box in any way - it is built in the form of a double ring. But here something else has caught my attention: Underneath there is an additional steel raceway, on which run machine bearings. This significantly increases the durability of this element, usually exposed to moisture, sand and soil. We can adjust the pads which controls the smoothness and reactivity of the base allowing to suit it right to your own preferences or to the wind conditions. Great, but I think we'll hardly ever be looking around there. For this reason Adam is already preparing an even better, more accessible solution.

The rocker box itself is made of two plywood rims connected by a battery of short aluminium tubes. This creates a composite structure with a cross-section equal to the sum of component thicknesses, which increases stiffness in relation to the section weight. Moreover, the height of this ring structure does not affect negatively the height of the main mirror above the ground. The Taurus base allows the primary mirror cage to travel below the level of the upper ring while rotating in the Alt axis, which significantly reduces the maximum height of the eyepiece. The rims are cut into side walls of considerable thickness (30mm!). In Taurus, they form an extremely stable backrest for the altitude bearings, which rest firmly on solid

Teflon machined pads, screwed in pairs of screws into appropriately milled bends. These prevent the skids from falling off the base. The entire Dobsonian base is extremely rigid in each axis and at the same time extremely low and lightweight. I have to say that it is a masterpiece of Dobsonian constructions and an element that I particularly liked.

Altitude bearings

This is another important element of Dobsonian telescope. They form virtual axis of vertical rotation of the telescope around the centre of gravity of the optical tube. As there is no typical tube here, there is no way to fix the axis in its correct position. The altitude bearings have to carry heavy loads when the telescope is directed low above the horizon.

In Taurus , altitude bearings shows nice, crescent-like shape and they possess high lateral stiffness, due to the high quality plywood, well selected thickness, circumference, profile height and placement of the strut in the most suitable place, not at all closest to the ends of the skids. A nice feature is special shape of ends of alititude bearings, which prevents them from falling out of the base when the vertical rotation range is exceeded.

Main mirror box

It becomes available when the secondary mirror box is unscrewed and removed. We use the same knobs and mufflers for this purpose, to which the truss will later be screwed. The main mirror box fits perfectly into the interior of the rocker box and creates one fixed unit. This is a real convenience and a clever transport security.

The main mirror box is made in the same concept as the telescope's base. It is very low-profile, compact and described in the plan of the truncated circle. The two plywood rims were joined together with 10 short aluminium tubes and plywood sidewalls. The altitude bearings are attached to them. The primary mirror box is naturally the heaviest part of the whole structure, weighing 18.5 kg. I must admit that I don't feel this weight and the fact that I am lifting massive, 16-inch mirror.

A very important advantage of Taurus's construction is that the construction protects the main mirror from above and from the sides, in contrast to the „ultra-light" structures, in which all sensitive optics are exposed to kicks, soil and falling accessories. Personally, I'm not convinced of the telescope, in which instead of enjoying the observation I still have to be careful on its mirror, so the solution in Taurus, which combines small size and high level of safety definitely fell to my liking.

As Adam told me, the special cover material of the main mirror will not break even if the heavy eyepiece falls. I preferred not to check....;).

The box of the main mirror in Taurus is truly minimalist, synonymous with high mechanical stability, excellent support and protection of optics and efficiency in material management. It surprised me how easy it is to move around.

Main mirror support

The main mirror rests on floating cell with 18 floating support points adequately distributed on the basis of calculations from the PLOP. This is the optimum number of points even for much thinner mirrors, and here a 45-mm thick piece of glass is installed.

The lateral support of the mirror is made up of a wide nylon strap, wrapping it at an angle of nearly 180 degrees. Here, a steel cable or a bearing support (so-called „whiffle-tree") is usually used more frequently. These distort sensitive edge of the optical surface less than the wide strap used here. As I have already mentioned, this is important mainly for thin mirrors, here a thick substrate forgives more, so I wouldn't be afraid of it. Wide strap is certainly a safer solution and, unlike steel cable, we are sure that the strap will always rest on its place, e. g. after a journey on a bumby roads. One should mention the wide, flat clamps holding the mirror from above, which limit the diffraction phenomena usually occurring on them.

Main mirror collimation

The collimation mechanism is maintained „in good tone". There are no annoying counterscrews here, as they are completely unnecessary in a good mechanism. The mirror position is determined by the 3 strong bolts and the embedded strong, pre-tensioned springs.

I really liked the fact that the collimation in Taurus works moving the entire cell and not the mirror alone, which guarantees the highest precision of positioning the optics in the cell, regardless of the position of the collimation mechanism.

Collimation screws are available not from the bottom as usual, but from above, on top of the primary mirror cage. Wide knobs give you a perfect feel, even in gloves.

Optics

The main mirror of my test telescope was made of borosilicate glass with low thermal expansion coefficient. This is a mirror of domestic production. It has clear aperture of 400 mm (16" blank used) and a healthy thickness of 45 mm. The focal length of the mirror is 1800 mm, which translates into F/4.5.

The guaranteed peak wavefront error is 1/8 lambda, or another put, the largest (P/V) deviation of the optical surface from the ideal parabola is 1/16 lambda. A great result from such an aperture.

The secondary mirror comes from the same source and has a shorter axis of 80 mm, resulting in an optimum central obstruction of 20% (linear). The maximum optical surface error is also less than 1/16 lambda.

Both mirrors have aluminium reflective coatings with SiO2+TiO2 multi-layer overcoat, applied in Poland with a modern high-vacuum technology. This results in a reflectivity of up to 96% in 500-550 nm range, low porosity and homogeneous thickness. After somedaylight examination I must confess, that these are indeed high-class coatings, without visible punctures, without discoloration, clearly visible at different angles of view and with a almost non-existent scattering of the collimator laser dot.

Truss assembly

The traditional Dobsonian telescope was equipped with cardboard tube. Here, due to high aperture and mobility of modern Taurus construction, a truss consisting of 6 pipes connected together was used. We have 6 joints and solid pipes made of durable 6063-T6 aluminum alloy, with a diameter of 30 mm at the 1 mm wall, which is over-dimensional in relation to the 16 „aperture and 128 mm truss pipe length. Such a solid truss poles exhibit excellent stiffness, quick dampening of externally-induced vibrations, and the lack of collimation wandering effect in function of height of view.

The unfolded truss is one unit and we are sure that nothing will be lost in the dark. It is fastened to the cages of both mirrors using screws with convenient knobs, to the threaded brass M6 sockets. brass combined with steel screws gives a nice,"buttery" feeling, a large control of the final tightening force and is very durable. After screwing down, the upper pivot points are ideally placed in the sockets of the upper cage.

Upper cage

Assuming it to the top of the truss, I noticed that it was another strong point of Taurus. A reliably designed secondary mirror holder with an elliptical glass separator makes the whole unit extremely resistant to torsional and bending gravity forces. As I know here is the secret of collimation in Taurus that it is ultimately so stable. Actually, pushing with the tip of the secondary mirror gives the impression of an attempt to move the rock. I don't know how he did it, but it is difficult to mount a secondary mirror better. Three-vanes spider, integrates mechanically with a 6-point truss, while at the same time providing an aesthetic diffractive effect, which I will write about soon. The top cage is equipped with standard GSO M-CRF microfocuser but Adam can mount literally any focuser available on the market upon your request. Focuser axis is set at a fairly steep 45 degree angle, contrary to 15-30-degree usually found in larger constructions. Interesting, how will it work in practice? My test Taurus had a finder bracket adapted to fit an optical diagonal finder.

Look and finish

As a person who doesn't pay too much attention to aesthetics (the telescope is supposed to work, not look), I won't say too much about Taurus. The only thing I can write about the aesthetics of the performance is simply high-end and that's it. Glossy surfaces, high-class powder paint on metal elements, perfectly matt (but not black!) finish on internal surfaces, precise CNC milling, meticulous finish of plywood using semi-gloss water-resistant coatings. Set up in the living room and watch. The regret is to pack it into the car....

But finally the night came so wonderful that it was necessary....

Evening on 8 January of 2018. The mobile high towed fresh, Atlantic air across central Europe. All day dry, withput snow cover, above zero degress Celcius and pretty comfortably. In the afternoon, the sky quickly cleared from the clouds, revealing a deep, uncontaminated blue sky. The air was stable, without excess humidity. I am familiar with meteorology. I knew that a special night was coming. Now, or never!

Competition doesn't sleep!

The test methodology required me to compare the Taurus telescope to my own telescope, custom-made and tailored to my taste. Maybe a few words about him. I did not spare for him. It hides a 14.7 inch diameter, F/5 heart made of quartz, with maximum optical surface error less than 1/18 lambda. The substrate is extremely thin at only 19 millimetres on the edge so it rapidly cools down to ambient temperature. This extraordinary mirror is settled on a carefully constructed floating cell with 27 support points. In order to ensure perfect collimation under all conditions, I have constructed my own truss for it. This time it is 4 splitted pairs of tubes made of 6083-T6 constructional-grade aluminum alloy. The secondary mirror is a top quality, pyrex Antares Optics diagonal, with 97% reflectivity coatings applied. The secondary mirror spider vanes are made of steel to achieve the minimum possible thickness and thus least visible diffraction. I installed the most amazing microfocuser you can buy - a great StarLight Instruments Feather Touch.

The eyepieces used with the scope are also reference. These are three Ethoi from Tele Vue. The 21,10 and 6 mm focal length ep's give me a sensational feelings every time I put them into my telescope. The largest, pound weight Ethos 21 mm is supported by the Baader MPCC coma corrector screwed into its 2" barrel. The quartz mirror with its excellent accessories has already shown many times that it can produce pin-point star images, smashing globulars into fine dust right into the cores and causing jaws to fall on the ground while showing incredibly contrasting details of the moon and planets. How will our test Taurus telescope in a duel with such a noble opponent?

Logistics

Taking two big Dobsonians alone into remote observation site for a trip is not easy. My Dobsonian telescope turned out to be less convinient to prepare for transportation than Taurus. The rocker box construction, a large cage of the main mirror, large altitude berings cause that despite the ultra-lightweight mirror weighing 9 kg, I absolutely do not feel that my telescope is more mobile. I would say the opposite is true. Let me emphazis, the Taurus telescope is a true mobility king!

Let's go!

I left the city. My observation site is more than 50 km away from the house. I was heading towards quite a dark sky with

NELM usually being at the 6-6.5 mag range. I stopped behind the village of Wrotnow, my observation place. I entered far into a large cultivated field, surrounded by forest on all sides. In the radius of a kilometre there is not a single building, nor a single light.

It was surprisingly calm and warm and the winter Milky Way was hanging to the horizon. There were rare for Polish skies conditions of great transparency and stable seeing at the same time. I quickly started to set-up both Dobsonians. While I can prepare my equipment in complete darkness even without the use of light, Taurus went a little bit worse because at the beginning I couldn't feel the lower fixings of the truss. OK, it finally succeeded, although I had to use more light than usual. Generally speaking, both structures are extremely convenient to set-up. This is inconceivable in the case of mass-produced 16-inch competition in the Far East. It is simply impossible to put one such a telescope in small car I possess and where two? I would add that apart from the two 16-inch truss telescopes, 2 passengers could go comfortably in the car - one at the front and the other at the rear, where there was enough space to accommodate e. g. two children and their backpacks. Wow!

Meanwhile, both Dobsons are already standing. Time to check the collimation. It turned out that it was better for me to collimate my own construction, strangely becouse of screws placed from below. Being at the primary mirror cage I usually look towards the focuser with the collimator placed there, not turning my eyes towards the screws, I turn two of them, skilfully setting the collision point where necessary.

Both telescopes were equipped with light shrouds but due to the darkness around, I did not take the trouble of applying them.

The perfectly constructed Taurus T400 allowed me to reach eyepiece with the telescope pointing up in the zenith easily from the ground and without getting up on my fingers, great! Steeply angled focuser also proved to be very comfortable. Unfortunately, the finderscope shoe in Taurus was inconveniently placed for Telrad finder and I didn't have an optical look with me. Remenber, as a small company, Adam can manufacture properly placed finderscope mount upon your own request.

The main point of that observing night was to show whether there is a difference in the image brightness of DS objects between the 14.7 „and 16" telescope. It was interesting for me, because Taurus' main mirror has, unlike my own, modern, efficient reflective coatings. The biggest drawback of my mirror is the simple evaporation applied reflective coating, which has low efficiency and has already been partially worn and scratched. I also wanted to check the sharpness of the image on the stars, taking into account thermal properities of these two such different mirrors. The atmospheric Seeing of that night was fantastic.

Eternal sparkling

And everything has started.... Taurus T400 and first object - M42, Great Nebula in Orion. Dark, so we go without a filter. The view in 16-inch aperture telescope with a focal length of 1850 mm, in excellent observational conditions with a reference 21mm focal length, 100-degree FOV eyepiece each time causes a real jaw-drop on this object. And this time I gasp at the sight of a nebula, spreading out as eternally flying umbrella, glowing with a strange, cold glare in the darkness. The entire field of 21-mm Ethos eyepiece was filled with airy nebula fibers with a subtle arc visible in its entirety, which surrounds and closes the central parts of the M42 creating something like an umbrella or, as you would like, a rose. The central region of the nebula seemed to spoil the night-time adaptation of the vision, while the components E and F of Trapezium were obvious, even with such a small magnification.

The comparison back and forth with my telescope showed a slight, general dimming of the M42 image in my equipment. The number of details of the nebula visible in my telescope remained relatively the same, but it was felt that the light was as if less. The most external envelope of the M42 was already beginning to vanish somewhere and the background seemed to be more black. Well, but those amazing needles in the Trapezium.... Wow! I love my telescope! Simply, again, the incredible, point images of the stars. Is it really bright Newton? Maybe APO? Regrettably the massive Taurus mirror was not able to thermally keep up with ultra-fast cooling and stable quartz. In Taurus, the stars were already slightly blurred from 21 mm and the effect intensified in 10 mm. Contrary to the quartz, the massive mirror in the T400 simply needed a little more time.... I was looking for a G component in my telescope with 6-mm eyepiece (308x magnification). Due to emotions and curiosity of Taurus standing near, I could not find this faint star this night.

Second object - Barnard 33 dark nebula lying against the background of the IC434 emission nebula in Orion. Commonly called Horsehead. So far I have seen this complex twice. First time in the 10-inch Dobsonian with Baader Classic Plossl 32 mm and H-beta filter in some great conditions. Another time there was incredible January night, on one of the passways on Princess Highway, somewhere between Victoria and New South Wales, literally when the southern skies of Australia opened up, and at NELM like 7.5 magnitude, with Orion in zenith, I saw the IC434 and Barnard's Loop in 10x56 binoculars without a filter! It's hard to believe it, isn't it?

This time the task is not easy, because we are in Poland (Orion is low, and the sky is good but even in a fraction not that great). This time Ethos 21 mm was helped by the excellent Lumicon UHC filter, which yields 93% transmission for the H-beta. I check on Flame, it is obvious, with a recognizable structure inside. It is good. Despite this, Horsehead was harder opponent than I previously thought.

In Taurus T400 I quickly noticed something like a faint brightening in the expected IC434 location, but only after removing Alnitak from the FOV. However, there is no trace of B33. I fought with this object for 5 minutes and switched to my telescope. Unfortunately, here the situation is even worse, is there IC434 on its place or not? I don't think so.... Blah, I'm coming back to Taurus. This time I think it seems more that the IC434 is actually there.... I use a telescope to wander with the nebula from edge to the edge of FOV. The fight continues. I guess I can see that B33. No! I don't see.... It's a bit confusing. I do not know. To be honest, I was tired of that. Again Taurus caught a little more light. On the other hand, Alnitak was less pouring light into the field of vision in my quartz. Subtle and non-obtrusive 3-vane spiders of both telescopes were basically identical to the eye creating particularly nice diffraction effect of six delicate spikes.

The Horsehead finally did not appear.

For relaxation I targeted Messier 45 in Taurus (of course!) Such big telescopes, having a focal length of 1850 mm, do not deal with this type of large objects too much, because the extended objects do not fit in the field of view of large telescopes. The T400, however, provided a still softer picture, little brighter and more susceptible to coma. I put Baader MPCC on the 21mm eyepiece to see how it will handle the coma from both mirrors. While in my F/5 mirror Baader „sweeped" the comma all the way to the diaphragm itself, in F/4.5 the edges of the 100-degree FOV started to show a little commas on the stars. But who likes starring at the Ethos diaphragm? The reflective nebula Merope, its visibility and span was comparable in both telescope. After M45 cluster it was the time for a unique photographic session of both Dobsonian telescopes.

In a whirl of impressions

After an interesting photo-session of both wonderful instruments under the picturesque sky of Wrotnów, it was time to see the M51 - a spiral galaxy, which was currently rising more and more over the north-eastern horizon. OK, I must admit that at the end of the night Taurus owned smaller contenter, right from the first glance offering the best spiral I have ever seen in the sky. Whole, complete, spiral structure. 10-mm Ethis FOV was filled by the continuous (!) bridge connecting this lovely galaxy with the nearby NGC 5195, which also revealed to me its elliptical nature. The image of such distant, small and dark structures with an efficient 16-inch mirror is unachievable for every smaller aperture. In my telescope, the bridge was a difficult, visible partially, and the woal of a spiral structure not so well defined as in the larger telescope standing next to it. The difference was clear, and only a dozen percent more light was enough to spot the difference!
Finally, a farewell shot from Taurus T400 in M42, again without a filter, because why bother in this beautiful moment? Eyes and senses fully sharpened to night conditions. Quartz stood still somewhere there.... Heavy mirror of Taurus probably finally achieved thermal equlibrium, because this time Trapezium was sharp like a razor. I didn't feel cold at the time, but I felt that finally I could see something really interesting in this new telescope. That's where my dream comes true. The long contemplation of bright band of the central part of M42 (the ribbon in the Trapezoidal area) in a 21 mm eyepiece finally makes it possible to see the subtle, true colors of the Universe with my bare eyes. The Turquoise glow of the nebula in one place contrasts with the greyish-pinkish coloration, creating a narrow line of division exactly on this clear cut. Breaking these colours is on the verge of perception, but I think I see it. Yes, I think yes! From now on pure fun. Well, for a moment....

Enough. Fatigue and cold takes over, it is time to gather home. I start to disassemble telescopes. Some kind of a glow has already appeared in the sky. It is a strange, distorted moon. It rolls slowly into the sky just above the forest. Well, it's deffinitely time to come back home. Packaging and return journeys always take too long.

Summary

Pros:

+ Classical, many years-proven design
+ Ultrahigh mobility, extremely lightweight yet strong construction
+ Easy accessible eyepiece even at zenith
+ Stable and precise collimation mechanism
+ Beautiful workmanship and finish
+ Integrated secondary heater
+ Customizable (focusers, finders, optics, finish)

Cons:

- Why it is not mine?

It was difficult for me to return Taurus when Adam arrived at the beginning of February. Summaries I leave to the readers, as long as they have made this long, boring text to the end. It is only my subjective experience. I would like to leave the judgement over highest class observation equipment to each individual reader. May everyone be as lucky as I am and have such an extraordinary opportunity to review beautiful telescope - Taurus T400!

REKOMENDACJA MAGAZYNU ASTRONOMIA

Taurus T400 F / 4.5 Classic is an amazing device, that's why we decided to award the „Astronomics Recommendation" as the highest class equipment for astronomical observations.