BAA

I & I News

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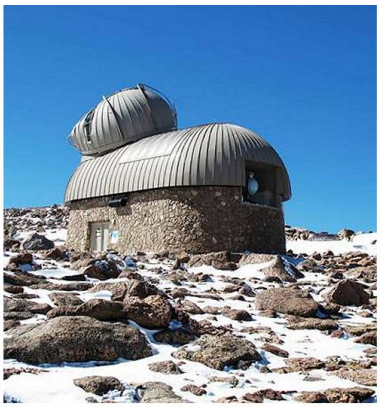
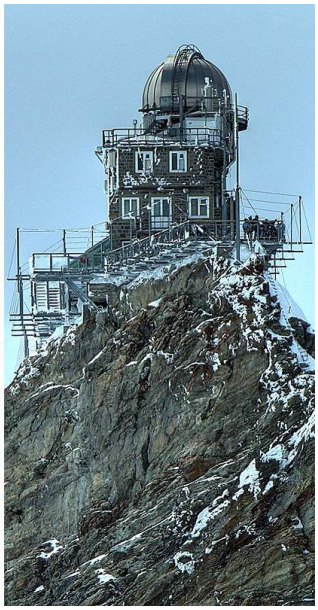
Animals and plants must adapt to their environment in order to flourish (though it seems to be the opposite for humans). In the same way, many observatories are designed for conditions in a wide variety of locations, such as the centre of a city, at high altitude, isolated on the African veld, or perched on a mountain peak, though sometimes there seems to be a bias towards aesthetics rather than utility. In Britain, local and seasonal weather must also be taken into account. Stewart Moore's observatory, for example, is located near the east coast, though his original description of the chilling wind is not included here.

Bob Marriott, *Director*





A run-off roof observatory

Stewart Moore

My run-off roof observatory houses a 300-mm f/5.3 Orion Optics Newtonian reflector on a Fullerscopes Mark IV mount. The walls are quite high, but this was deliberate (though they could have been 6 inches lower), as I live near the east coast and the wind can be very strong and very chilling at times – and as I am a visual observer this is all the more noticeable. I can reach a lower southerly declination through the open door if necessary, but I rarely need to do so.

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Restoration of a 4-inch f/15 classic achromatic refractor

Phil Jaworek

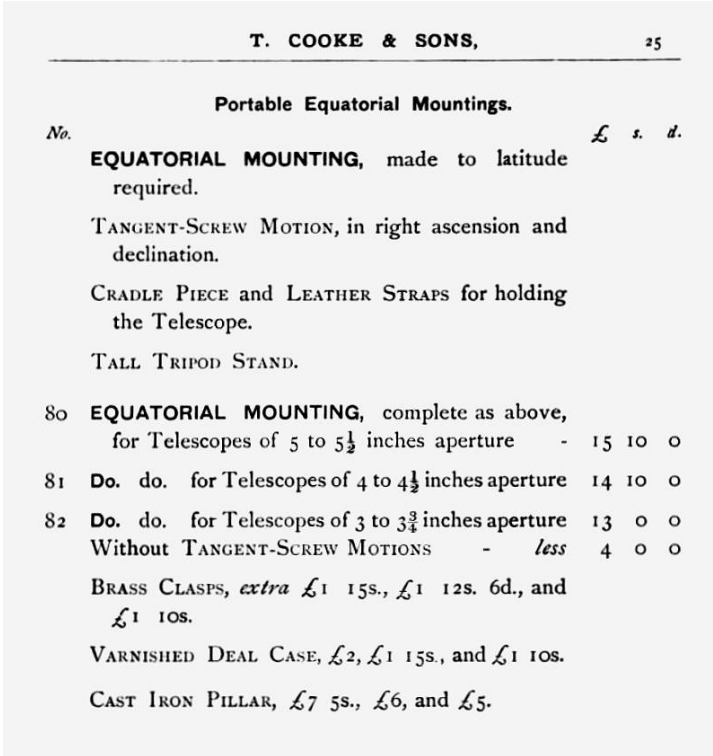
Those who attend the Kelling Heath autumn star parties or the Stargazers Lounge spring star parties may have seen, on my pitch, what appears to be a monster antique telescope: my 4-inch f/15 refractor. I must admit that this restoration project has been rather an obsession over the past few years, as I have tried to realise my dream of recreating a long-focus refractor from the late nineteenth century.

Since I acquired the main components in 2010 the telescope has evolved steadily to a point where I can now refer to it as 'almost finished'. I say 'almost' because deep down I know that I will always be tinkering. The following is a brief account of my four-year journey.

Early in 2010 I acquired a very unusual old equatorial head, won at a local auction house as part of a large country house estate sale. The lot included the mount head, a counterweight, an elegant mahogany RA slow motion remote spindle, and a clean example of an early-twentieth-century 3-inch Broadhurst Clarkson Starboy refractor. Unfortunately, the lot did not include a tripod, but this did not deter me from bidding healthily, as I could see the potential for realising my dream.

The Starboy optical tube was marked in two areas which corresponded with the mount cradle positions, so the two had been used together for some time; but it was obvious that the mount was capable of handling a telescope much larger than the 3-inch Starboy, which was clearly over-mounted and seemed a little lost.

The wooden block of the mount showed outlines of the manufacturer's nameplates, but unfortunately these had long since been lost. However, further investigations revealed the mount to be a product of the renowned English telescope manufacturer Thomas Cooke and Sons, of York – the year of manufacture of this example being around 1870. In Cooke's catalogue of 1886 (p. 25) it is described as a portable equatorial mounting 'made to latitude required ... [with] Cradle Piece and Leather Straps for holding the Telescope' – all for £14 10s 0d (in modern equivalent terms, around £1,450). I must admit to some amusement at this description, and I admire the astronomers of the day who used it as a 'portable' mount, as it is by no means lightweight. In fact, it almost matches my Celestron Mk1 CGE mount head in weight. Whenever I set up the telescope



T. COOKE & SONS, 25

Portable Equatorial Mountings.

No.		£	s.	d.
	EQUATORIAL MOUNTING, made to latitude required.			
	TANGENT-SCREW MOTION, in right ascension and declination.			
	CRADLE PIECE and LEATHER STRAPS for holding the Telescope.			
	TALL TRIPOD STAND.			
80	**EQUATORIAL MOUNTING,** complete as above, for Telescopes of 5 to 5½ inches aperture -	15	10	0
81	**Do.** do. for Telescopes of 4 to 4½ inches aperture	14	10	0
82	**Do.** do. for Telescopes of 3 to 3¾ inches aperture	13	0	0
	Without TANGENT-SCREW MOTIONS - *less*	4	0	0
	BRASS CLASPS, *extra* £1 15s., £1 12s. 6d., and £1 10s.			
	VARNISHED DEAL CASE, £2, £1 15s., and £1 10s.			
	CAST IRON PILLAR, £7 5s., £6, and £5.			

The mount temporarily fitted to a Celestron CGE tripod.

I can only wonder whether the gentleman astronomer who originally owned the instrument would have set it up himself or instructed his servant to set it up for him. If the latter, then the weight would not really have been an issue for him.

When I first saw the mount I knew that it needed something a little more substantial than the Starboy, and I therefore began to search for a similar aged or contemporary refractor in the region of 3½–4 inches aperture, with a focal length in the range f/13–15. A telescope of this size would be within the capacity of the mount, but more importantly it would satisfy my craving for a classic long-focal-length refractor. A Cooke telescope from the same era would be ideal; but I had to be realistic, as these are few and far between, and those in useable or restorable condition fetch very high prices. So, alternatives had to be considered – but only if they were of good optical quality, looked right for the period, and were not too modern in appearance.

The 3-inch Starboy.

In the late 1970s I had the pleasure of building my first real astronomical telescope: a 6-inch Cassegrain/Newtonian reflector, using parts supplied by Fullerscopes. At the time I lusted after the Fullerscopes 4-inch and 6-inch Deluxe/Export refractors, but as a poor engineering apprentice my weekly wages could only stretch to the mirror kit. However, my fascination for classic long achromats persisted, and over the years I have owned and restored several telescopes of this type. A Fullerscopes Deluxe or Export refractor from the 1970s or 1980s would therefore be an ideal candidate, and the project would probably be more feasible than any attempt to find a Cooke telescope contemporary with the mount.

Within hours of beginning my search on the Internet I found a listing for a Fullerscopes 4-inch refractor on the Peak 2 Valley Instruments used equipment page. A quick chat with the owner, John Timings, revealed the telescope to be an f/18 model, which seemed promising, and when I visited I discovered that it was an early Fullerscopes refractor from the pre-Broadhurst Clarkson Fuller days. Unfortunately, it was not really suitable for my project. All was not lost, however, as sitting in the corner of John's yard was my dream telescope: a beautiful black and brass 4-inch f/15 Deluxe Fullerscopes refractor. What luck! The telescope and a pair of genuine Fullerscopes cast aluminium tube rings were duly purchased from John, and I drove home on cloud nine, knowing that I now had a telescope to match the mount.

The 4-inch Deluxe Fullerscopes.

Close examination of the object glass revealed that the telescope was made in 1979, and was no doubt assembled by (the late) Ernie Elliot, of Broadhurst Clarkson. During testing, the optics were found to be excellent apart from ghosting on bright objects – the cause of this effect being traced to one of the spacing foils between the objective elements having been replaced incorrectly at some time in the telescope's history. Therefore, new spacers were made and fitted, and the problem was cured. Now all I needed was a tripod.

Initial test pairings of the mount and telescope were carried out with a temporary arrangement using a modern Celestron Mk1 CGE field tripod, this being the only tripod I had available that could take the combined weight and bending moment encountered with long telescopes such as the 4-inch f/15. The tests were useful in that they illustrated just what a tripod for this set-up must be capable of to be of any practical use.

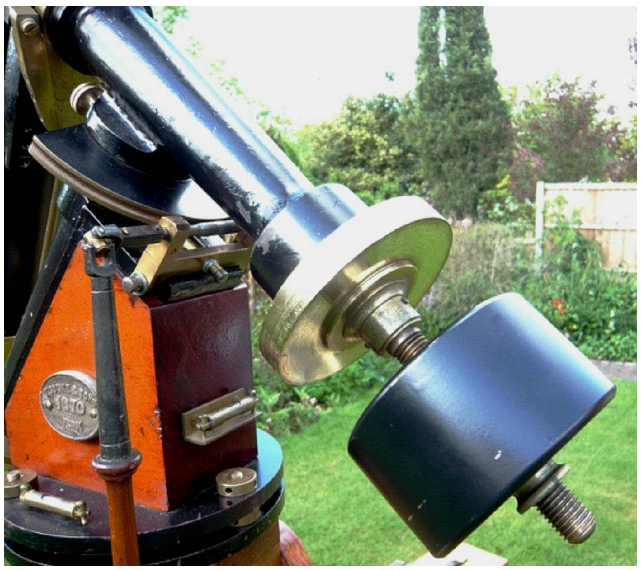
Ordinarily I would have been faced with another search for a rare antique item: a Cooke tripod from the nineteenth or early twentieth century – but after a few searches on the Internet came to nought I decided to build a tripod myself. Being of a practical disposition and knowing my way around woodworking tools, this was not too much of a challenge. I had already built an ash photovisual tripod for an HEQ5 Pro mount, so it would not be difficult to produce one of twice the size. As it happened, it was twice as difficult – but it was an enjoyable process.

I had the will; now all I needed was the way – or to be more precise, a photograph or pattern of a Cooke tripod to work from. The 1886 catalogue illustrations were a start, but a more substantial pattern was needed. After a chat with Richard Day of Skylight Telescopes he kindly allowed me to pore over his similarly aged 3-inch Cooke telescope and tripod, providing me with a better pattern that required only a slight up-scaling for the 4-inch.

I built the tripod over the course of a few days. The legs and spreader bars were made of American white oak, and the head was made of a large piece of lignum vitae (which had been in my garage for several years) – offcuts of which were used to make the spreader centrepiece and spreader-to-leg fixing blocks. All the oak was stained to resemble mahogany. My first attempt, however, produced much too bright a finish, but a clean-down and restain with a more tasteful colour helped. Furnishings such as the brass head bolts, spreader bolts, and capstan nuts were made by myself, copying the Cooke style as much as possible.

My only concession to modern tripod technology is the accessory tray. This is made of mahogany and plywood, and has more than enough room for accessories. In my experience, a tripod-mounted tray is an essential accessory for the visual observer – ranking equal with an observing chair – so for the sake of practicality I was willing to accommodate a departure from the antique design.

Although the mount's cradle and straps were still in reasonable condition, I did not consider that they would hold a telescope the size of the f/15, so they were replaced with the Fullerscopes cast aluminium tube rings, following refurbishment with brass thumbscrews and new lining felt. The mount's removable base-plate was now permanently fixed to the tripod head, providing a sturdy and rapid means of attaching the head with the original brass levelling screws and capstan nuts.



The refurbished mount, showing the new counterweight, original RA drive, and head-levelling capstan nuts and spirit levels.

Once mounted, the instrument proved far too weighty for the original cast-iron counterweight, so early tests were made with the addition of a pair of small Decathlon dumbbell weights. In 2013 these were replaced with a new single cast-iron counterweight, made, in the style of the Cooke original, on my lathe.

The original Cooke declination lock screw was quite short, which was acceptable when used with the Starboy, but because of the longer tube of the 4-inch I had to move from the eyepiece to lock the declination axis. This proved awkward, so I manufactured a longer version from brass, using the Cooke catalogue illustrations as a guide.

The longer lock screw made operation much easier and brought control closer to the eyepiece, but some form of slow-motion control for the declination axis was still required. Copying the Cooke spring-tensioned tangent screw method from scratch was a little beyond my lathe and metalworking skills, and would also require a new brass declination clamp arrangement, so this was not really an option.

A rummage through the forgotten recesses of my garage revealed a dead 1970s Towa equatorial mount, fitted with a spring-loaded tangent screw slow motion on the declination axis and worked in a similar manner to the Cooke designs, though not as elegantly. After cutting off the mechanism from the Towa mount, I modified it and pressed it into service on the Cooke. When the day arrives that my lathe tread cutting skills have been honed I shall replace this with an all-brass version.

The declination lock screw and slow-motion control rod now brought the declination shaft control closer to the eyepiece, and to avoid confusion between the two controls in the dark I made the brass thumbwheels different sizes – a convenient little addition, of which I feel Thomas Cooke would have approved.

In my opinion, the all-brass Fullerscopes MkIV focuser complete with brass finder makes the instrument really stand out from the crowd, and gives it a period look. It is surprisingly smooth in operation, and the side wheel internal rack focuser is responsive, though unfortunately the basic 25-mm finder fitted by Broadhurst Clarkson Fuller is inferior. Although the finder, with its lacquered brass finish, looked the part, optically it was poor, and the fishing-line reticule in the Ramsden eyepiece had to be replaced with something more useable.

The declination locking and slow motion rods.

Early in the project I bolted a standard 9x50 Skywatcher finder to the main tube, but this was not convenient to use and did not look right. A 9x50 brass finder, by Ian Poyser, was therefore acquired from Skylight Telescopes, and after a little modification it was fitted in place of the Skywatcher finder. This arrangement looked right but was still not in a convenient position to use. Ideally, the new finder needed to be in the same position as the Fullerscopes finder, so I fabricated a new set of aluminium brackets, copying the originals in style but scaling up to hold the new larger finder. In addition, a little internal reinforcement of the focuser walls was required to avoid stressing the brass tube with the extra weight. The replacement finder is now in the correct position, and works well.

I cannot abide the look of over-polished brass. In my dabblings in antiques over the past twenty years I have seen many telescopes, binoculars, and microscopes polished until you can see your face in them from 100 yards. To me this is wrong, and ruins the appearance; thus my aim with this project from the outset was for a working telescope, not a museum piece. A working telescope will become scratched and marked, and provided there is no major trauma this adds to the patina of the instrument.

The replacement finder and new brackets.

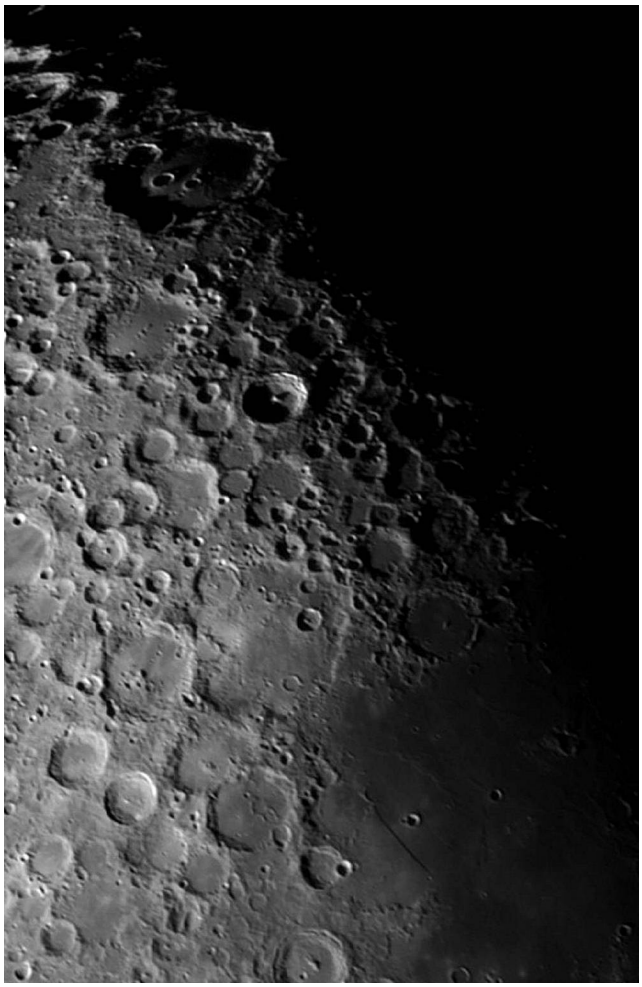
Therefore, restoration has been restricted mainly to a repaint of the telescope tube, a light polish of the brass-work, and some relacquering in areas where the brass had discoloured. After stripping off the Fullerscopes black wrinkle-finish paint I was pleased to find that the dew cap is also brass, so I polished and lacquered it to complement the brass Mk1V focuser. Restoration of the mount consisted of cleaning and lubrication where appropriate.

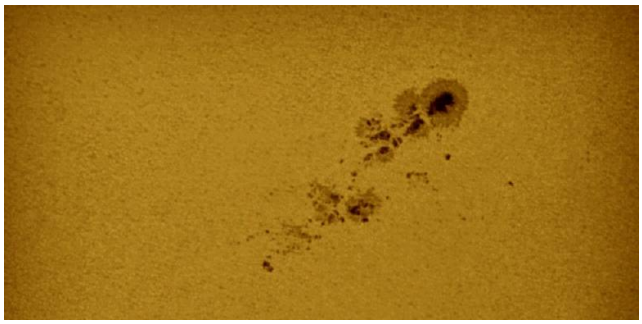
The declination setting circle was complete, and with the period engraving it looked good and worked well; but the RA circle had not fared so well over the years, as a previous owner had removed the original graduations and scored his own into the perimeter. A few hours of lathe and milling machine work brought the RA circle back to serviceable order, but I must admit that my new markings, although usable, are not as elegant as the declination circle engravings.

As far as the optics were concerned I did not need to do much at all, apart from a clean and the fitting of new spacers to eradicate ghosting. I have also modified a Williams Optics 1¼-inch carbon-fibre diagonal with brass side panels and a brass eyepiece barrel, complementing both the appearance and the performance of the instrument.

Finally, I cast two new 'T. Cooke & Sons York 1870' oval nameplates out of brass resin to replace the original nameplates, which were missing – moulds for the casting being taken from another Cooke mount of the same period (with many thanks to Patrick Lindfield for his help). A set of volcano-top Circle T orthoscopic eyepieces in a modified vintage oak microscope case completed the set-up nicely.

So, after all this hard work and dedication I can quite confidently say that the telescope performs very well. I have spent many happy hours watching transits of the jovian moons, viewing features on Mars, and splitting close double stars; but my all-time favourite subject is the Moon, and I can become lost just following the terminator down its length at magnifications of 400x plus on nights of good seeing. The accompanying images illustrate the optical quality and performance of the telescope – though they cannot, of course, reproduce the impressions attained by visual observation.





My pitch at the SGL7 (2012) star party at Hereford. The 4-inch and my Meade 127 apochromat complement each other under a clear sky. (Photograph by John Hicks.)

Anyone visiting the Kelling Heath or Stargazers Lounge star parties is most welcome to see and look through the telescope. It is a joy to use, but its presence and elegance make a night of observing an event, so I am pleased to say I have achieved my original aim.

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A home-made dome

Keith Venables

I had spent many hundreds of hours building my 18-inch Newtonian and its equatorial fork mount, so it deserved a good home if it was to be both easy to use and well protected. With the low pivot height inherent in a telescope of this size, a run-off or folding flat roof was not viable, so I was left with the option of either a run-off building or a dome. The run-off building might have been the easier option, but allowance for the run-off would take up about twice as much garden space as a dome, and would offer very little protection against wind and stray lights while observing. So, a dome it would be.

The minimum diameter required was 3.2 metres, but larger domes are not so commonly available and hence are quite expensive. About forty years earlier, while at school, I had helped make a fibreglass dome and decided to explore making my own. About this time I came across someone else with the same ambition, so we embarked on the project together.

The dome was to be cast in twelve segments. This would need a reuseable mould, made from four layers of fibreglass and resin. I first had to make a segment out of wood (called a 'plug' or 'former'), and from this we would cast the mould. I am quite good at carpentry and so making the former was not too difficult, but this was probably the trickiest part of the project. Any errors or imperfections would appear twelve times on the finished dome – for all to see!

With the wooden former complete, we moved on to the messiest part of the project. Fibreglassing is not difficult, but the resin is, of course, very sticky and ends up everywhere. Disposable gloves and decorating suits are essential, along with gallons of acetone for cleaning up. The finished outer surface of the dome segments is achieved by using a coloured 'gel coat', applied first to the mould during the casting process, before adding two layers of resin and fibreglass.

The third and final stage of assembly was perhaps the easiest and most satisfying. We had a steel ring for the base and aluminium tracks for the aperture custom rolled. Although by far the most expensive part of the project, these items made for a very sturdy and functional design and a watertight shutter mechanism.

A little while later I added a servo drive based on windscreen-wiper motors, and, with some help, developed an Ascom compliant driver that works with the mount drive to keep the aperture aligned with the telescope.

After eight years the dome continues to work perfectly, with no leaks and no signs of wear. The mould has been borrowed by other friends, and has now produced a total of six domes! Interestingly, all but one were finished in dark green. It certainly blends into gardens nicely, which can be vital in maintaining relations with partners and neighbours, whilst not catching the attention of vandals or thieves. A drawback is that it absorbs more solar heat than does a white or silver finish, but I mitigated this by adding a large thermostatically controlled exhaust fan in the dome.

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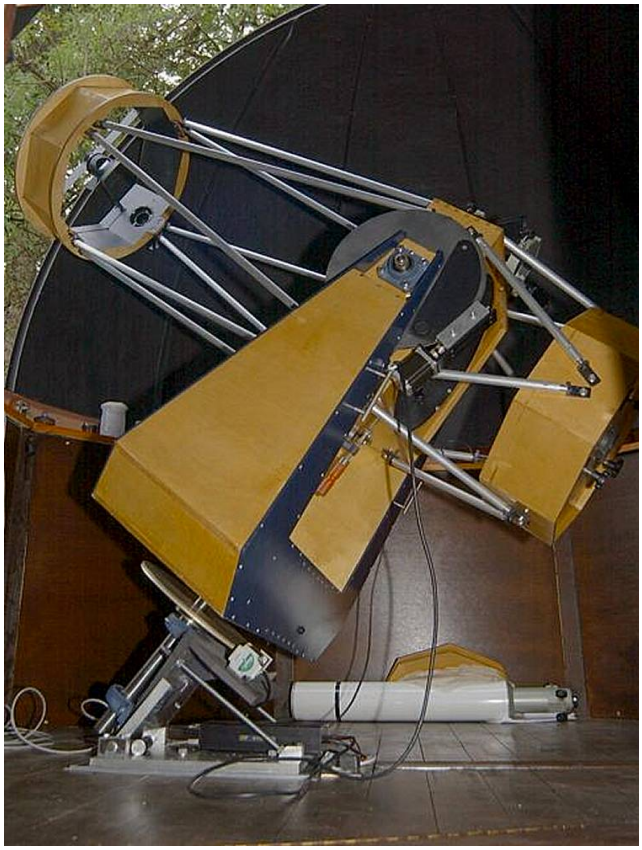


An ‘undesirable’ observatory

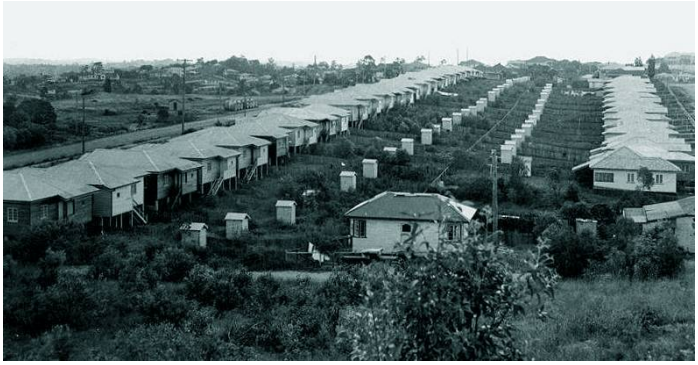
Peter Anderson

In Brisbane, where I live, there was a huge suburban post-war housing boom. Many of the houses had out-houses, usually equipped with a septic system, in the back yard, and during the 1960s many of these outer suburbs and country towns were sewered, leaving a surplus of outhouses. Everyone knew what they were, so they were not a desirable item to keep.

However, an old friend of mine, Merv Jones, of Maryborough (about 200 miles north of Brisbane), extended and modified one of them and put it to good use as a roll-off roof observatory for a 10-inch reflector (superseding a 4-inch refractor that he had used for several years). Merv was a great artist, and in the 1960s I forwarded many of his drawings (on behalf of the Astronomical Society of Queensland) to the BAA Lunar Section.

Merv was an interesting character. At the end of 1961 he sent me a calendar (the months are under the cuckoo clock), which I still have in my possession. It can perhaps be considered a comment on amateur-built telescopes. My first telescope, however, was built under supervision at an adult education class, and I can attest to its quality. The photograph of me when much younger was taken by my friend Peter Smith. Unfortunately, I have lost track of Merv and Peter.

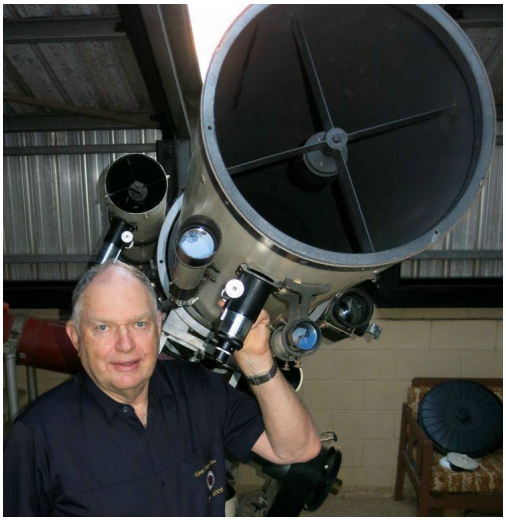
Brisbane, Queensland peteranderson53@bigpond.com



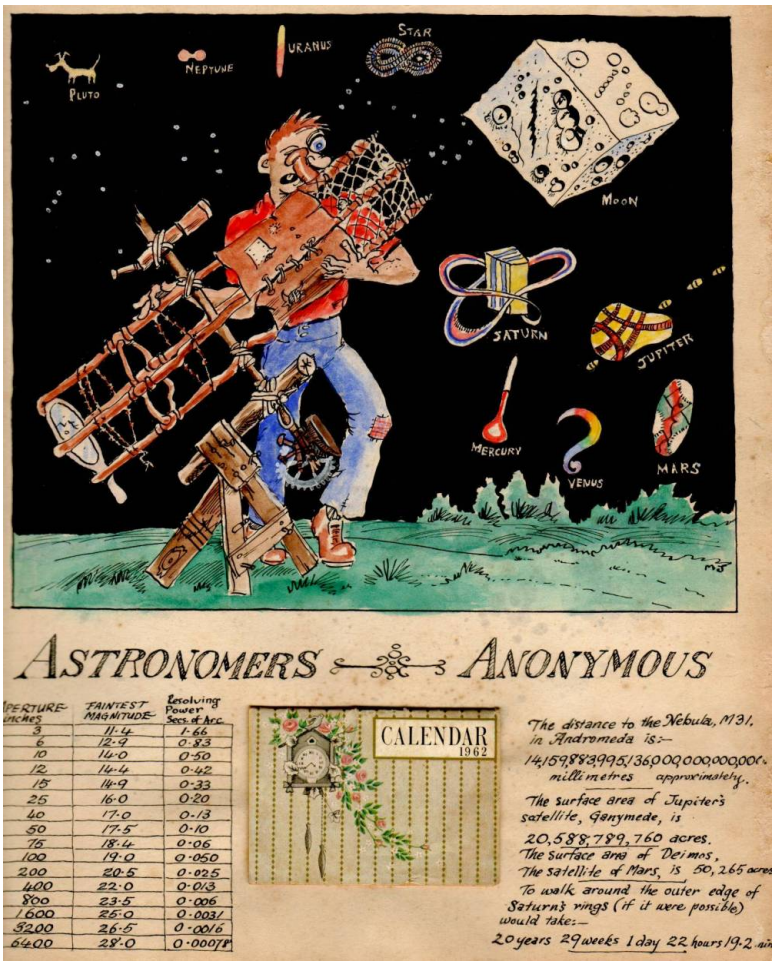
Houses built by the Queensland Government Housing Commission at Norman Park (a suburb of Brisbane) in 1950. (Photograph courtesy State Library of Queensland, John Oxley Library.)

Merv Jones and his converted outhouse.

Then ...



... and now.



An observatory for a small garden

John Elder

At the end of September 2013 I decided to tackle some deep-sky imaging and purchased a Skywatcher 10-inch f/4 Newtonian reflector on an NEQ6 Pro mount.

Our back garden is small (11 x 6 metres) and paved, but I felt that for the size and weight of the set-up a permanent location would be desirable. (What I can lift now, at age 62, will certainly be much less in ten years' time.) The wall of an existing shed and the adjacent fence would form two sides of the observatory. A stout wooden frame formed the third and fourth sides, the easterly of which was covered with lapped planks. The fourth side, facing north-west and hopefully sheltered from the prevailing weather, was left open.

The roof was the trickiest element and, to cut down on weight, an opening design of two parts was constructed on heavy-duty hinges. The larger part is controlled by a pulley system and an extendable pole that has so many uses that it was probably the best £10 spent on the project. Little conveniences such as a shelf for a laptop, red lighting, and multiple sockets were also installed.

The observatory withstood the wettest and windiest winter for years, but as an added precaution a garden chair cover was used to protect the telescope, which, except the electronic controls, is left outside all the time. The adjacent barbecue has now been used several times for highly successful 'astronomy parties' with friends, and the cover adds another horizontal surface on which the paraphernalia of astronomy can be placed.

The costs were: wood and planking, £200; hinges, bolts, screws, tar-paper, and electrics, £50. There are more costs hidden in the small details, but as I decided to omit the fourth wall I have a large surplus of wood.

The benefits are in the use of the existing infrastructure, which has proven to be robust, while the disadvantage is the restricted space, though the telescope can turn freely. The paved garden is not as stable as might be thought, and it pays to stand still when taking time exposures.

Two of us erected the frame in about a day, while the remaining bits and pieces could also be done singly in a few days. However, iterations with the roof design and appalling weather delayed full completion until late 2013.

In the photograph [below], the strange object that looks like an American water tower is a very simple cover (£10 for a garden trug and a collapsible garden basket) for an HEQ5 Pro mount, held in place with a 2-kg dive weight on a bungee cord. The mount holds either my old Celestron C8 or an 80-cm refractor, which lie in the shed and can be affixed very quickly. The observatory can be prepared for use in less than 15 minutes, and the smaller mount in about 5 minutes. If the skies are clear I have the luxury of choice: 500-mm f/6.3, 1,000-mm f/4, or 2,000-mm f/10.

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An observatory in East Sussex

Peter Smith

My observatory is founded on a brick base, with a dustbin at the centre, to take a tube that constitutes the pier. The brickwork base has six sides and the walls have twelve sides, every other floor joint cantilevers over the wall, and the floor is separated from the mount to limit vibrations. The walls consist of a timber frame and 9-mm ply, with 3-mm thick insulation and a hardboard lining, and the dome is made of 4-mm ply covered with 3-mm thick roof insulation and tarpaulin. The slit – with a 0.6-metre clear opening – runs on furniture movers in plastic electrical trunking. The cabinets are used for storage of eyepieces and other equipment. When I built the observatory about ten years ago it cost around £1,200 including automation and software, and recently I have coated it with fibre-reinforced paint, which cost another £50. It is situated at the edge of the patio, so is as near the grass as possible, 5 metres from the house, and close to the shed where the computer is kept.

The observatory houses an Orion Optics UK OMC 250-mm Maksutov–Cassegrain (f/9, or f/6 with a focal reducer) with Atik cameras and a motorised filter wheel, and a Skywatcher 102 refractor with a MoonLite motorised focuser, on a Celestron CGE mount. I also have an Imaging Source planetary camera, which can be used with a Star Analyser filter, for planetary work or for wide-angle shots.

The dome is turned with an old reclining-chair 24V motor connected to the computer via a Velleman USB interface board (£30) and Pierre de Ponthière's shareware dome driver. The dome, the mount, the Atik cameras, the filter wheel, and the focusers can be run from the computer in the shed, using ASCOM's POTH software. For visual observing, however, I can override the automation and control the position of the dome and telescope by using the hand control of the chair motor.

A short video of the observatory can be seen at: https://www.youtube.com/watch?v=SUBebOQBcXA.

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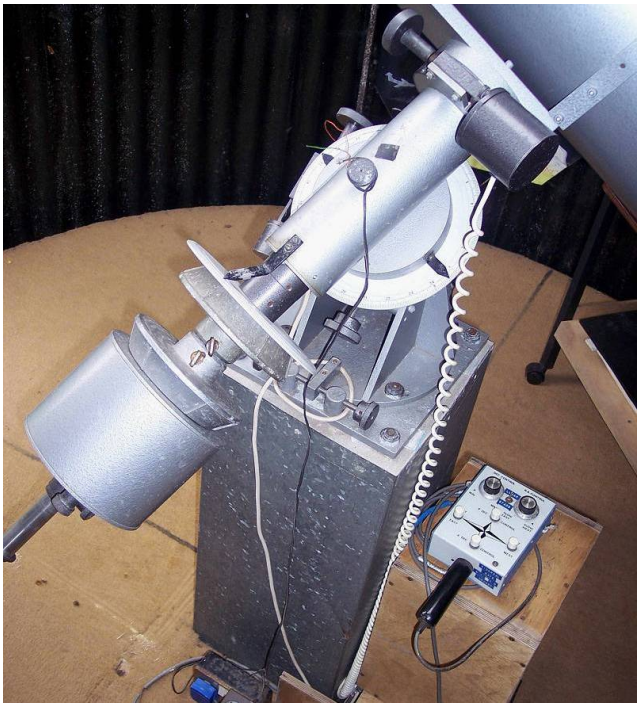

A cylindrical observatory

Pierre Girard

In November 1981 I acquired a 4-inch f/13 Vixen refractor, but eventually tired of assembling it each time I used it, and the optics were prone to dewing during observing.

Therefore, I began to conceive plans for a proper observatory. This also coincided with the availability of materials from redundant farm buildings (my own). The design I chose was a cylindrical structure with a 20-inch wide slit extending past the zenith. Central to the plan were steel rings to provide a circular track and support for the cladding, though the most difficult aspect was the design of the roof hatch. The steel rings were ordered on 22 April 1982 and collected on 10 May, and the design and building was continued until 20 June, when the observatory was completed. The total recorded costs amounted to around £250.

In 1985 I sold the 4-inch refractor and placed an order for a 10-inch f/4.5 reflector with Rob Miller at Astro Systems in Luton, and in October that year the observatory interior was modified to accommodate a very different set-up. A new 8-foot pier was cast to provide a stable base, and the floor was raised a foot with recycled and donated materials. The new telescope arrived on 26 October, and by 2 November it was installed on the pier and I had first light. The conversion cost very little – which was fortunate, as the price of the 10-inch was quite hefty for the time.

Recently I acquired a 16-inch Dobsonian reflector, and I also have further plans.

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