I & I News

New Series No. 24 — Newsletter of the Instruments and Imaging Section — 29 April 2015

In this issue: mirror-making, a classic instrument, and more designs for observatories. First, an article written by John Thomson a few years after the founding of Optical Surfaces in the early 1960s. I thank Norman Child for permission to reproduce this article from the company's website.

Bob Marriott, *Director*

Optical Surfaces: the start of it all

John V. Thomson

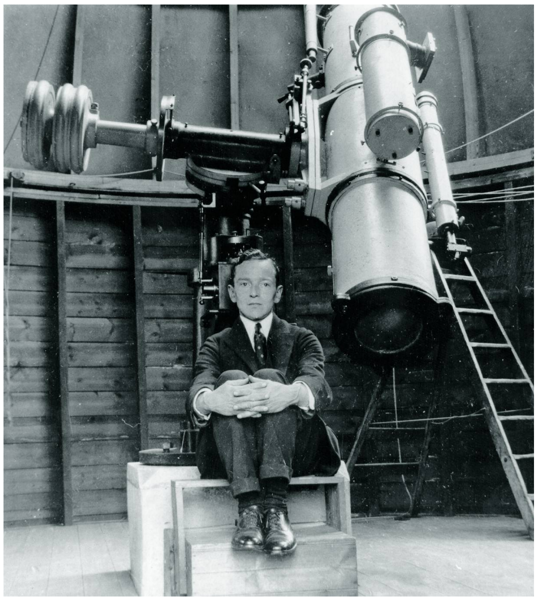
John Thomson and F. J. Hargreaves. Frames from the film at http://www.britishpathe.com/video/telescope-makers/query/coulsdon

Partnering the local postmaster's wife in a two-piano war-time concert effort, and Optical Surfaces Ltd, seems a far cry. But, there is a direct link. On the lady's shelf was a book on astronomy. This I borrowed, became very interested in the subject, and consequently became a member of the British Astronomical Association. The President, Mr F. J. Hargreaves, made astronomical mirrors in his spare time. I had a go at an 8-inch parabolic mirror, and became fascinated in the work. This was followed by a 12-inch mirror, which slid off the polisher onto a concrete floor whilst my back was turned, with disastrous results.

The then Astronomer Royal, Sir Harold Spencer Jones, was aware of the excellence of Mr Hargreaves' work, as were other professional astronomers, and suggested to him that there was a real need for such skill in full-time employment: 'If your work interferes with your hobby, give up your work', to quote Hargreaves. So he planned to give up his work as a patent agent and start an optical company when the war was over. I heard of these plans, and my offer to join him was accepted. Mr H. W. Cox, who was also an amateur optician (with his brother, he made the first Schmidt camera in this country) offered to join the company. Thus in 1947 the firm of Cox, Hargreaves and Thomson Ltd was founded, with 'premises' in Coulsdon, Surrey. Mr Cox never in fact became a member of the firm, and I began work with Mr Hargreaves in 1950 after a year or so's experience with the 200-inch telescope optics which were being made at the California Institute of Technology.

The workshop behind the Brighton Road consisted of three garages which had been knocked into one, and had served as a surface air-raid shelter during the war after the walls and roof had been reinforced. From such humble premises emerged a 50-inch diameter spherical mirror which went to the Mount Stromlo Observatory, Australia, a 30-inch parabolic mirror for the newly mounted reflector at the Royal Greenwich Observatory, 24-inch and 27-inch diameter coelostat flats (the largest fused silica flats to be made in this country at the time) for the solar observatory in Rome, and various other impressive optics. The need for temperature control was very obvious from the first, and in 1951 the company took over the tunnel shelter underneath Cane Hill Hospital, where the optics for many medium-sized telescopes were completed, including a Schmidt system with a 47-inch primary mirror and a 32-inch corrector plate, made for the Royal Belgian Observatory.

It was in 1955 that Mr Mortleman joined the Company, having given up a promising career on guided missiles at Fairy Aviation Ltd for the fascination of optical work. He willingly accepted a considerable reduction in salary as a result of his enthusiasm. True dedication indeed! He brought to the company a freshness of attitude towards optical work, and contributed many original ideas in expertise. Being



F. J. Hargreaves and T. E. R. Phillips' 12¼-inch Calver reflector (now BAA instrument no. 93), Headley, *c.*1930.
(Royal Astronomical Society, © Headley Village)

impatient to get a job done in the quickest time and still maintaining the specified accuracy, he developed new methods and devised short cuts to achieve this end. His best effort was to make a 28-inch spherical mirror for the University of Louvain in nine days. This included doing all the polishing by hand, with the aid of an 'oar' with which he 'rowed' the full-size tool across the surface of the mirror. The university confirmed afterwards that the required tolerance of $\lambda/10$ had been more than met, their independent measures indicating errors of the order of $\lambda/15$ and $\lambda/20$.

By 1961 it became obvious that the company would never progress until radical changes were made in management, and proposals were made by Mortleman and myself to the two other Directors. These were rejected out of hand, and we had no alternative but to leave the company and set up in business on our own. A stained-glass window designer and manufacturer in Stoats Nest Road, Coulsdon, was leaving the district and his property was up for sale. This was purchased by C. C. Mortleman, from whom we rented the premises, set amongst a small apple orchard. Insufficient capital and long hours produced tools to make carpenters' benches, thus enabling us to make machines on which to produce reference surfaces for testing our prospective customers' components.

Although the Company was formally founded on 13 April 1962, Optical Surfaces had in fact been in existence since early in January, and had produced some optics and been paid for them before the formation date! They were busy days; the three founding Directors (the third was Jim Hysom, who had walked out of Cox, Hargreaves and Thomson Ltd 'in sympathy') spent all of their money and nearly all their waking lives getting the firm going. Very great help in the preparation of the workshops was given by one Jeff Spalding, a remarkable character who was then on a British Petroleum 'sandwich course' and was able to work with us during his vacations. He had an extraordinary knack for making hardware out of conversation, and once built twelve polishing machines singe-handed in a week. Unfortunately for Optical Surfaces he decided to stay with BP, who, after all, could offer him glamour, money, and security far in excess of the wildest dreams of Optical Surfaces. Lucky BP!

Considerable help came from other quarters in other ways (which was just as well, since there was a mini-recession in 1962, as a result of which much of the well-paid work we had counted on from Hilger and Watts failed to materialise). I have already mentioned Mr C. C. Mortleman, who provided the Stoats Nest Road premises; another was Mr Parsons of J. Pearson and Sons Ltd, who put sufficient work our way to enable us to keep going in those precarious early days. He also saw to it that we were paid promptly. Who can say that the firm would have survived its infancy without help such as this?

In 1952, F. Twyman, Technical Advisor to Hilger and Watts, had brought out an enlarged second edition of his textbook *Prism and Lens Making*. I was able to supply him with photographs I had taken of the 200-inch telescope optics in process of manufacture, together with a write-up of the work in the Institute's optical shop, for inclusion in the new edition. He thought my collection of photographs would interest the head of their optical shops, and that was how I met Harry Yates, Hilger and Watts' optical manager.

Having no diamond milling equipment at Cox, Hargreaves and Thomson, we had been very grateful to Mr Yates for getting this preparatory work done for us in Hilger and Watts' shops. We in turn did sub-contract work for them in the form of 'large' mirrors – anything from 6 to 16 inches diameter! Mr Yates continued to carry out this work for us after Optical Surfaces had been founded, and Optical Surfaces carried on some of the sub-contract work from Hilgers, which was very helpful during our first two years' trading.

Mr Yates continued to take an interest in our company, and in the autumn of 1963 he said to me, 'Hey, do you know what?' I replied, 'No, what?' His reply was 'I would like to join Optical Surfaces. Will you have me?' Of course, the answer was 'Yes', and so the 18-month old company, with three founder Directors and a crew of one, was joined by Mr Yates, after thirty years with Hilger and Watts. The association was to prove mutually beneficial. Optical Surfaces was able to widen its range of products, and acquired new techniques, while Mr Yates learned at first hand the odd but effective machine methods which Optical Surfaces had developed, from its background in astronomical optics. Almost at once he was made a Director, in spite of his frequently expressed desire to become an ice-cream vendor!

Relations with Hilger and Watts remained friendly until Charles Pataky joined us after answering our advertisement for an Optical Manager. There followed an estranged period, until eventually the rift was healed, and we found ourselves once more making 16-inch Ebert spectrograph mirrors and other optics for Hilgers.

Shortly after Charles Pataky joined the Company, Jim Hysom left to start his own business in Luton, his home town. He had always been interested first, last, and in the middle in astronomy, and was not very happy with the trend of production at that time. Optics for the amateur astronomical market had proved a hard way to earn a modest living, but nevertheless that was what Jim wanted, and Optical Surfaces was clearly not headed that way. In the outcome, it seems that Astronomical Equipment (Luton) Ltd has provided him, and John Mathers who left us later for the same reasons, with the way of life which suits them. Happiness is indeed beyond price, and I for one hope that these two early pillars of Optical Surfaces have found it and will hang on to it. As a result of Jim Hysom's leaving, Charles Pataky was made a Director in September 1966.

Since the days with Mr Hargreaves, we had appreciated the vital importance of constant temperature, and began to look for underground premises in 1962/63. We knew of the existence of the Riddlesdown Shelter and its suitability, but every approach to the 'Powers that Be' resulted in a negative attitude, disinterest, and a dozen and one reasons why we could not occupy the place. Our numbers were increasing at Stoats Nest Road, and the orchard had long gone, the area being occupied by two new buildings. The temperature in the polishing shop varied by as much as 15 degrees on a summer day, and optical testing became nigh on impossible by the passing of some 750 trains per day within 50 yards of the eyepiece. More than twenty-one years of fruitless effort and search went by, during which time we had examined most underground areas in the surrounding countryside, including Chislehurst Caves, hearth-stone workings outside Caterham, shelters under Epsom Down, brick-works beyond Godstone, war-time underground emplacements beneath Reigate Hill, and many others. It was at this time that Mr J. H. Stevenson came on the scene and began to take an interest in us in his role as Secretary of the National Association of British Manufacturers (now the Smaller Business Association Ltd). He took up the cause on our behalf, with the result that the 'Powers that Be' suddenly mellowed their attitude towards us, even showing enthusiasm towards our requirements. Thus in July 1966 we vacated Stoats Nest Road, and moved into our present premises, thanks to the ruggedness of Mr Stevenson's Irish powers of persuasion.

Director's note During the Second World War, Surrey County Council commissioned the building of four deep shelters, including Coulsdon Deep Shelter, built within the grounds of Cane Hill Asylum. After the war the shelter was purchased by Cox, Hargreaves and Thomson, but the cold and damp conditions eventually led to corrosion of equipment and reduced the morale of those who worked there. After the company left in the early 1970s the tunnels were eventually sealed by the local council.

Frank Knight: astronomer and war veteran

Bob Marriott

Frank Knight joined the Association in 1934, when he was 24, and in the same year bought his house in Chadacre Road, Epsom. In 1935 he purchased, from the widow of Robert C. Sclater, a 5-inch Cooke refractor (dated 1859), which was set up for him by W. H. Steavenson. (Slater was science master at Charterhouse from 1896 to 1924. He joined the Association in 1905, and was Secretary from 1910 to 1913. A few years later he reverted to the surname of his great-grandfather: Sclater.)

Beginning in 1936, Frank submitted thousands of observations to the Variable Star Section over more than fifty years, and in 1985 he received the Steavenson Award, though he continued to observe until he developed cataracts. During the Second World War, while serving with the 8th Army in North Africa and the Middle East, he made binocular observations of variable stars – including his favourite, R Scuti. During that time he wrote several letters to Frank Holborn (Secretary of the Association), who published a selection of extracts in the *Journal*, under the title 'Astronomy from the army' (52 (1942), 201). One of these letters, written a few days before the Battle of Gazala, included a drawing showing a narrow-crescented Moon illuminated by earthshine, Jupiter 3° or so north of it, Mercury about 5° west, Betelgeuse east, and β and ζ Tauri:

> 1942 May 17, 18h 30m. I have just witnessed the above magnificent sight in the western sky at nightfall out here in the desert; a faint Zodiacal Light extends upwards from the same region and adds to the glory of the scene. Mercury is within one day of greatest eastern elongation and has been a conspicuous object in our early night skies for the past ten days. It is not the shy little object that we occasionally see in our English skies – if we are lucky! It is really bright – about 0m.5 I estimate at the moment – and easily visible when only a degree or so from the horizon. Earlier in the evening, at the hour of twilight, when it is quite high up in the sky, it is not merely easy but quite a prominent object. When you have watched the skies in these parts, as I have during the past six months or so, you realise that the ancients were not so remarkably clever in recognising Mercury as a planet (as some of our textbooks would have us believe), for it would be impossible for anyone to fail to observe it out here. At the moment of writing (10.30 pm = 19h 30m GMT) a large part of Centaurus is visible, but not α and β Centauri; those two lovely stars, which I used to admire in South Africa, just fail by a degree or so to clear the horizon here. Also, at this precise moment tonight, the north galactic pole is almost overhead – actually it is crossing the meridian only 5° south of the zenith; as a consequence the Milky Way practically coincides with the horizon, and all the galactic constellations are ranged round it; something we do not see in England. The skies I admired most were those of a few months ago when the Milky Way stretched across the sky like an immense arch, passing very near the zenith. Even in its faintest portion (between Betelgeuse and γ Geminorum) it appeared as bright as the Aquila portions do in English skies, and the gradual widening of the Milky Way north and south of that point was very easy to see. Now I am hoping that I shall wake up early one morning so as to view the richest part of the Milky Way – the Scorpio–Sagittarius region – that is such a marvellous sight from the tropics.

In addition to these letters, Frank contributed four articles to the *Journal*, all of them published during the 1940s: 'The counterglow' (53 (1943), 35), 'Nova (T) CrB 1866 and 1946' (56 (1946), 56, 64, 74 – his discovery of the outburst of this star, eighty years after the previous outburst), 'Comet Giacobini–Zinner near variable stars X and SS Aurigae' (56 (1946), 150), and 'The irregular variable star R CrB and its light curve during the last twenty-five years' (57 (1947), 40).

In 1992 Frank offered his Cooke refractor to the Association, and I visited him to collect it. Over many years I have moved several of these immensively heavy instruments – most of them on my own, though sometimes with help. In this case I was assisted by an old friend, Robert Goodman – an actor who has appeared in many films since the 1970s. His roles have included the English soldier who murdered Joan of Arc's sister (though there is no historical evidence that this happened) in *The Messenger*, the leader of the Forty Thieves in Martin Scorsese's *Gangs of New York*, and various other villains and shady characters. In more recent times I have been helped by my son Paul.

Robert Goodman: actor and assistant instrument shifter.

Paul Marriott lifting 220 kg (485 lbs).

Unfortunately, Frank's telescope was in very poor condition, though this was not his fault. He had always lived alone, and after a career in banking and with few financial and family commitments he retired early and took to travel, including three voyages around the world. He had remained staunchly independent, but had had encroaching glaucoma and cataracts for several years. A 'helpful' neighbour had assured him that the instrument was being kept covered and in good condition, and had also been charging him a fee for collecting his groceries and other provisions from local shops. It was rather sad to see the eccentric way that Frank lived. The house still had its 1930s decor, but apparently had been untouched and was run down: a red flagstone floor in the kitchen, with a stone sink and one tap supplying cold water only; an occasional low-wattage light-bulb; a 'bed' consisting of several stacks of newspapers and a blanket; and a garden shed full of boxes of packet soup.

The telescope first had to be dismantled, which took quite some time, as most of the joints and bolts were locked solid. Nature had also taken over. Besides branches engulfing the entire instrument, a bird's nest (fortunately not occupied) was ensconced in the glass-fronted clock. The entire column – an enormously heavy single piece of cast iron – could only be laid on its side and rolled, and due to the bell-shaped lower end this rolling motion was a succession of numerous small arcs. In addition, due to heavy rain, the column repeatedly became stuck in the mud. During one of the short breaks in our efforts, Frank brought us a mug of coffee each and then returned to the house. After our first sip we each had a burning sensation in the throat, so we immediately spat out this strange-tasting brew and ejected the contents of the mugs into the undergrowth. Later, while in the kitchen, we noticed that Frank washed his crockery with Ajax, and did not rinse anything.

The task of moving the column from the end of the long garden, past the house, and through the front garden, occupied three hours. Then, fifty-seven years after being erected by W. H. Steavenson, the entire instrument was transported to a new home. In 2008 it was loaned to John Armitage, who, with his colleagues, restored it to its present condition.

It is remarkable that Frank's journals, which he showed us during our visit, recorded observations

made at El Alamein and other locations during the desert campaign. These journals were kept immaculately – ruled in red, and with neat and precise handwriting. When Frank died, aged 95, in 2005, his executor was a bank. His house was cleared, and the journals were lost.

Frank Knight was a Member of the BAA for seventy-two years, an enthusiastic and accomplished observer, and a veteran of the Desert War.

The 5-inch Cooke refractor in 1992.

On display at the BAA Exhibition, Manchester, 22 June 2013.

Construction of the Old Barn Observatory

Terence King

This observatory was developed from an already existing structure built of concrete blocks and measuring 16 x 9 feet. It had been used for a variety of activities over many years, but the flat roof presented problems, including leakage during adverse weather conditions.

After removal of the roof, the placement of the telescope mount was considered. The building runs north–south, and I decided to place the telescope at the southern end (the far end in Figure 1). My thoughts were to have the mount high enough to see the horizon – but I cannot see the horizon! However, as first thoughts are often good, I adhered to this idea, and from lengths of material from the old roof I made a box section 5 feet 8 inches long.

Standing the tube for the mount on end, and using all manner of objects to ensure that it was vertical, it was time to start mixing the concrete. Enough mix was used to fill the first 24 inches, or thereabouts. Allowing this first fill to harden would act as an aid in keeping the 68-inch plinth as near to true vertical as possible. Two 48-inch lengths of steel studding were also set in this mix.

The drawing (Figure 2) shows one of four 'feet' comprising part of the completed plinth. These are concrete blocks, added while waiting for the first mix to harden. The ½-inch space left between the blocks and the vertical when the ply casing was removed was easily filled with a mortar mix. To finish the pier, three bolts were embedded, heads down, in the wet concrete at the top of the structure, for adjustment and levelling of the telescope mount.

The initial construction of the roof was started on the ground, which was certainly more easy than working with ladders. Figure 3 shows the join at the ridge of the roof. The point here is that ¼-inch ply was attached to both sides of the join because it was to hand and because it is very tough. Shown laying alongside the roof structure in Figure 4 are two wheel assemblies. The material used for these two giant 'roller blades' was 2 x 2-inch timber and 5 x 1-inch prepared wood, short lengths of ¼-inch studding with nuts to fit, and Micro Scooter wheels. Angle iron, fixed to the full length of the roof, sits on the wheels. Figure 5 shows a wheel as it is today – as good as new, silent, and neighbour friendly.

After attachment of the wheel assemblies to the top of the walls, the woodwork was lifted into place. Figure 6 shows the wheels, angle iron, and ply joiners.

The next stage was the placing of the sheeting, and 8 x 4-foot x ¼-inch ply panels were screwed in place with a generous overhang on all sides. With the sheeting in place (Figure 7) the whole assembly became a very rigid structure, and by this time I had abandoned the idea of a lightweight roof that I could handle with ease.

The next task was to fit the felting (Figure 8) – an operation that

Figure 1

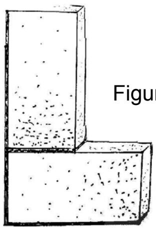


Figure 2

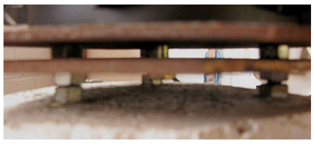


Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10

Figure 11

Figure 12

was certainly more tricky than fitting the ply sheeting. But there were no major mishaps, and a few hours later the job was completed.

By this stage, all work had been carried out by two people, apart from the lifting of the wooden structure by five people. We now had a rolling roof, but no extended support.

Two box sections 8 feet long and 5 inches square were then made, with one side of each section extended to 17 feet (Figure 9). This long length was attached to the outside edge of the wheel assemblies. The length of movement required is just 7 feet, so when opened for observing the roof is well weighted to the building. The run-off extension takes no weight at all, and is just a safety backup.

Figure 10 shows the north fixed gable. The whole section is made with tongue-and-groove slats, strapped together with battens and fixed to the north-end A-frame. The south gable had to be hinged in order to allow the roof to be rolled back to expose the telescope. This hinged section also serves a secondary function. Although the roof is not sealed in any way to the building walls, during summer days the temperature can rise to an unacceptable level. By opening the south end (Figure 11) a wind-tunnel effect is created, and cooling of the telescope to ambient temperature is achieved quite quickly. With the telescope being about 8 feet above ground level, a staging floor with two steps was built from reclaimed floor-boards.

The next important step was to fit the warm room (Figures 12 and 13), which must of course be isolated from the rest of the building. The ceiling is made of plaster board, with the partition wall made up with a 2 x 2-inch framework and with plywood sheeting attached to both sides of the frame. In addition to the entrance door, another door provides access to the telescope, and a double-glazed window allows a view of the PC monitor for quick and rough focusing at the telescope. Fine-tune focusing is carried out by remote control in the operating area.

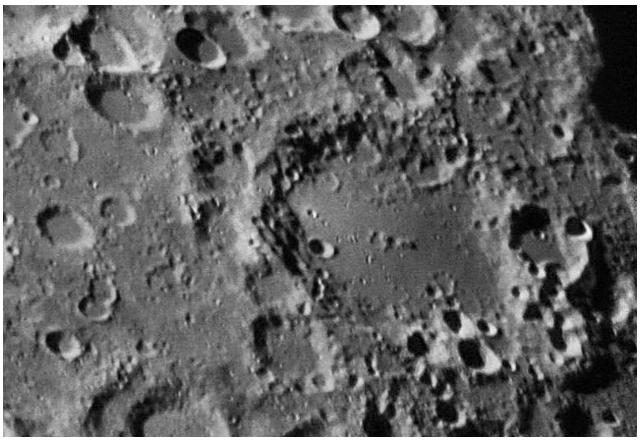
Concerns about the weight of the roof were unfounded. Very little effort other than a small amount of pressure applied to the A-frame is required to move it, and it runs smoothly and is extremely quiet. The finishing touches shown in Figure 14 were provided by my wife.

The instruments housed in the observatory are an 8-inch Meade LX90 SCT carrying a Skywatcher ST and the arbitrary finder. The entire system is rigged for astrophotography, with a ToUcam for AVI format and a Canon EOS 450D both for AVIs and for long-exposure deep-sky imaging. A few results are included here.

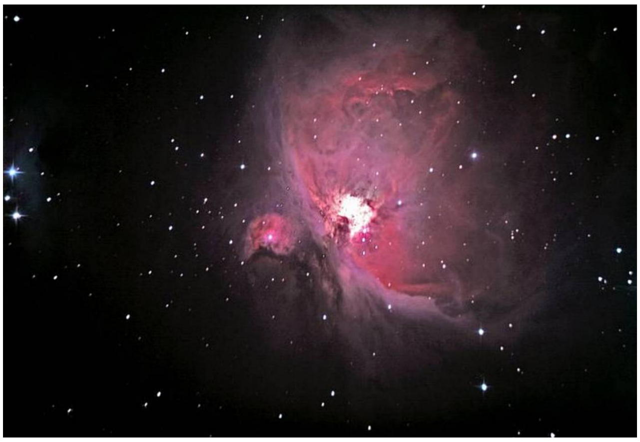
Southwick, Sussex tobo.southwick@virginmedia.com

Figure 13

Figure 14

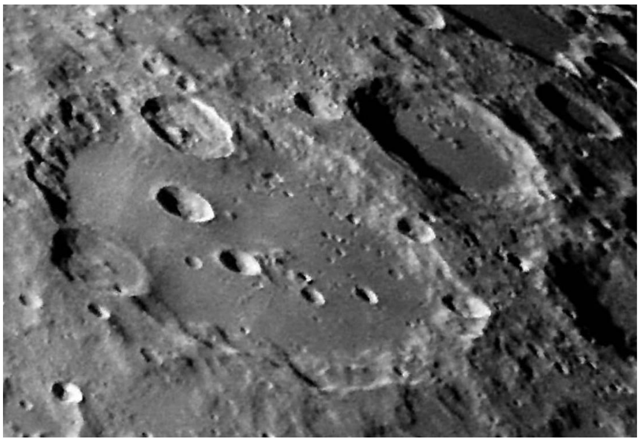


Maginus

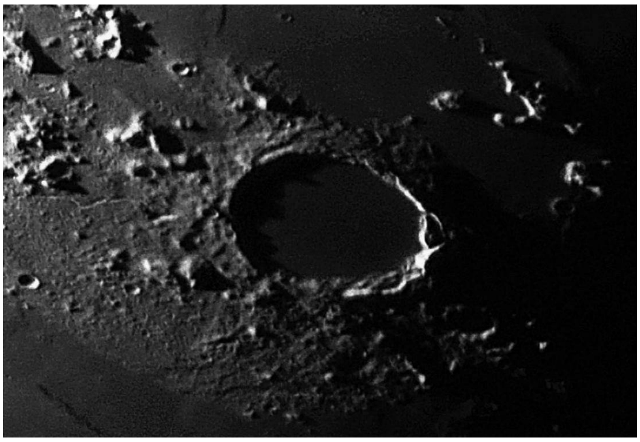


M42

Io and the shadow of Ganymede



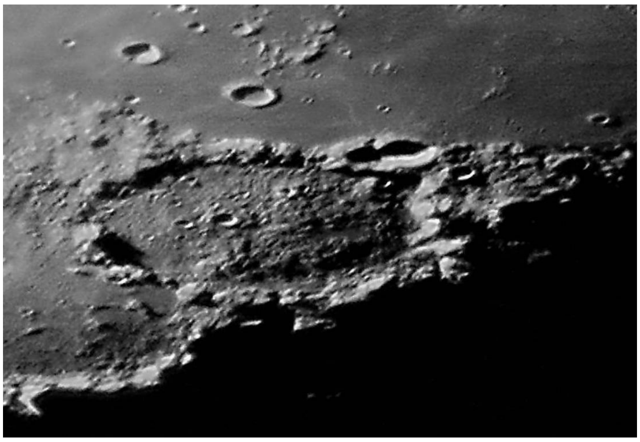
Clavius



Plato

β Cygni – Albireo

Rosette nebula



Herschel

Two observatories in Shropshire

Douglas Renton-Cooper

The first of my observatories, completed in 1991, is 10 feet square with a hinged roof. The temperature equalises as soon as the roof is opened, and the seeing is not affected in any way. Even when the weather is very cold the protection provided by the sides and with the roof opened even partially are very beneficial.

The observatory houses a 4½-inch f/14.7 refractor made by Jim Hysom of Astronomical Equipment (Luton) in the early 1960s. The performance of this instrument is very good. From 1964 to 1967 I was stationed with my family in Singapore, and it was there that I designed the mount and had it made in an aluminium foundry. The axis shafts are mild steel and run in a plain aluminium bearing. With good lubrication the movement is very smooth and is easily driven by a synchronous motor.

I also have an 11¾-inch Newtonian reflector with a mirror by Astronomical Equipment (as marked on the back with a diamond), mounted equatorially and driven by a synchronous motor. Originally it was covered by a tarpauline when not in use, but the coatings on the optics suffered badly with condensation, so my wife suggested that I build an observatory for it. It is 8 feet square, with an easily operated run-off roof.

Another of my telescopes – my first good instrument – is a 3-inch refractor with a mahogany box and several eyepieces, purchased for £7 10s in 1956. Whilst I was in Singapore, the instrument was stored for me by Colin Hunt (who proposed me for BAA membership in 1958). He knew W. H. Steavenson, who was at Cambridge at the time, and asked him for his opinion of this instrument. Although there is no name on the telescope, according to the mounting of the objective and the performance of the instrument it was, in Steavenson's opinion, made by Thomas Cooke. I have compared it with modern 3-inch refractors, and its performance is superior.

I also have a 5¼-inch f/11 refractor by Wildey, which performs very well. At one time it required some very particular optical work to remove a fungal infection on the flint element of the objective. This work was carried out by John Nichol, entirely to my satisfaction. The original altazimuth mount has been replaced by a Pentax equatorial mount – the only mount good enough to take the weight – and I made a new tripod of ash. The entire instrument is about as large and heavy as a telescope can be and still be portable. I am a STEMNET ambassador, and the Wildey telescope is the instrument that I display when I present talks on astronomy at schools in Shropshire and Staffordshire.

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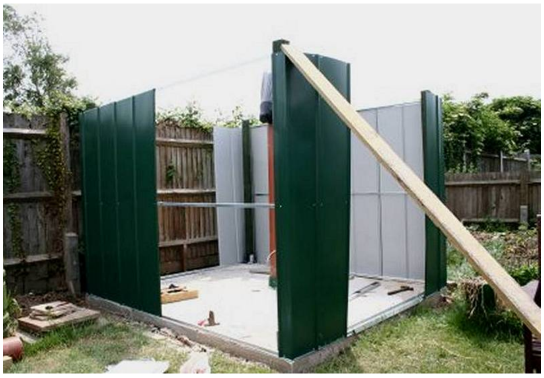

A garden-shed observatory

Brian Halls

I had always wanted a proper fixed observatory, and in 2009 I began construction of a building of the roll-off roof type. My inspiration came from seeing, on the display by Crayford Manor House Astronomical Society at the BAA Exhibition in Greenwich earlier that year, Keith Rickard's observatory converted from a galvanised shed:

http://cmhas.wikispaces.com/PutlandsObservatory

He, in turn, had been inspired by Mark Baines' Linnhe Observatory:

http://www.linnhe2.free-online.co.uk/observatory/

Each of these observatories houses an SCT. My instrument, however, is a 150-mm f/8 refractor, mounted equatorially on a tall pillar, for solar, lunar, and planetary work, so the roof had to be higher.

The observatory was built over a period of about four weeks – making the most of the fine weather in early 2010 – although much of the material had been purchased over the previous few months. It is based on the galvanised metal garden sheds obtainable in some garden centres and at specialist stores, so to all intents and purposes, most of the basic construction followed the manufacturer's guidelines. This particular model measures 8 x 8 feet, and when I purchased it the price had been reduced by £200.

To convert this garden shed to a roll-off-roof observatory I constructed a timber skeleton of four corner uprights to which the walls of the building were secured. These uprights also support a track along which rolls the original roof, built on its own subframe fitted with 3-inch wheels. It was a fairly simple job to add 6 inches to the height of the building by laying two 16-foot lengths of 3 x 3-inch timber onto the east and west side to act as tracks for the wheeled roof, with a clearance of half an inch between the top of the telescope and the timber roof support frame.

The gap between the top of the original walls and the tracks was covered with ship-lapped timber, with a further length of ship-lap fitted on the roof subframe that acts as a skirt and covers the walled ship-lap when the roof is closed. Additional ship-lap was used on the south side of the building (the direction in which the roof rolls off) and again on the north side with a flexible material – damp-proofing material used in brick-laying – to allow the roof to move freely when rolled to the open position.

During the day, my wife gave the wooden parts of the building several coats of green preservative, and as soon as I arrived home from work I continued with construction. Once the structure was completed, the electrics were connected to the domestic supply and the home security system was extended to the observatory. When closed, the building is weather-proof and protects all the equipment.

Necessity is the mother of invention, and the designs that have appeared in the Instruments and Imaging Section newsletters show the ingenuity of many BAA members.

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An observatory at Farthings

Peter Vickers

My objective was to build a domed observatory as economically as possible. The 2.2-metre dome kit, including the bearings and rail, was purchased from Pulsar, while the base is standard garden decking with six supporting posts set and levelled in concrete. The pier is a stainless steel pipe with a 150-mm flange, acquired from a very good local scrap yard. It is set in a concrete block and does not touch the deck, and because it is only 100 mm wide I provided it with extra support with two heavy-gauge aluminium bar supports bolted into the concrete block. The base circle and the top dome supporting circle were cut from 18-mm marine ply 100 mm wide, and each circle segment was joined with 18-mm ply plates glued and screwed. The wall was formed with standard studding and UPVC cladding, interlocked and secured vertically, and thereby enabling a circular wall to be formed. The floor was covered with building membrane polythene sheet and interlocking sponge mat. The total cost was about £2,000 around three years ago.

I am becoming too old to carry an EQ6 and equipment, but with this permanent setup I can commence viewing or imaging within a matter of minutes. I tried a Skywatcher 200-mm Explorer 200PDS initially, but found that with an equatorial mount there was insufficient room for the telescope and myself, so I have now settled for a C8 – an ideal instrument for a small observatory.

It should be noted that Farthings is not named after the well-known house in Selsey. My bungalow was originally, in the 1960s, two small bungalows with the address 1 and 2 The Farthings.

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A kennel observatory

Alan Snook

At our previous home I had a run-off-roof shed housing a 30-cm f/6 Newtonian on a fork mount. I remember Mars at a favourable opposition not emerging from behind the neighbour's house until the prospect of work the following day demanded my retiring to bed; and I remember obstructions such as telegraph poles impeding my attempts to observe the comet Shoemaker–Levy 9 impacts. Large areas of sky were permanently off limits.

When we moved home five years ago I expected to install the Newtonian in a fixed location, as before. Initially, however, I had insufficient time to set it up, so in the meantime I bought a 2005 vintage Beacon Hill 50-cm f/4.5 Dobsonian. Despite requiring three people to lift the tube alone, it moves around easily on four 10-cm caster wheels. At first it was kept in a garage, but I soon realised that mobility was a big advantage. Although we have a decent-sized plot and are situated on a ridge, the choices for a fixed observatory were all subject to compromises.

The 50-cm is now housed in an 8 x 4-foot 'dog kennel' which has no moving parts other than the doors, so it is a straightforward construction with no weatherproofing issues. The doors have small windows so that no-one can see whether there is anything inside which can be converted to cash, and wire mesh soffits provide plenty of ventilation. The only work and cost involved the building of the kennel, which is situated at the end of a level garden path that was already in place. This path provides about 80 feet of runway and allows me to work around trees and buildings, so I have access to almost all of the stellar hemisphere. Only the horizon from west through north-east is obstructed by trees on adjacent farmland, but they are a valuable windbreak. The locality is not called Cold Blow without good reason.

The telescope now has a full complement of dew heaters, and the controller is fed by a mains wander lead. I have also added digital setting circles, but if they are used it is necessary to level the base. The telescope came fitted with hefty M24 coarse screws at each of the four corners and 12-cm tommy bars fixed at the top end. These are fine on paper, but using them was slow and awkward, so I discarded them and instead use a lever and two made-up wooden step-blocks. I expect some bright spark could fit the screws with motors, two inclination sensors, and a Raspberry Pi, and have it all happen at the push of a button.

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A reconvertible observatory

Robert Bone

Due to the limits of the location, and as I might be moving house within a few years, I did not want (nor have the budget for) a permanent observatory with a pier set in concrete. Over a couple of weekends late in 2012 I converted a 6 x 4-foot shed costing £149 into a semi-permanent roll-off-roof observatory with a double door facing south. The observatory houses a C11 on a Celestron CGEM mount, with the legs of the tripod extending through holes in the floor and standing on a concrete base, thereby providing insulation from vibrations. The instrument is used primarily for imaging, and I have replaced the garden table with shelving for a laptop, providing more space when setting up. I also have plans for incorporating a small 'warm room' in the area over which the roof rolls. The whole project cost around £300, and if necessary the observatory can easily be dismantled and relocated, or reconverted to a regular shed.

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A potential observatory

David Graham

I am currently considering the construction of an observatory to house my 6-inch f/13 refractor or 9-inch Maksutov–Cassegrain, depending on the instrument used. Both instruments can be assembled on the same mount, but not at the same time. The most cost-effective practical solution will probably be a run-off structure on rails – possibly along the lines of that used by W. H. Steavenson to house his refractor (illustrated in Hutchinson's *Splendour of the Heavens*). The ultimate design will need to cater for the height of the refractor and the width of the Maksutov–Cassegrain. I have had the refractor for thirty years, and I am not the first owner. The pillar on which the mount sits is the lower section of a second-hand streetlight with a power supply running up the centre – beating swords into plough-shares!

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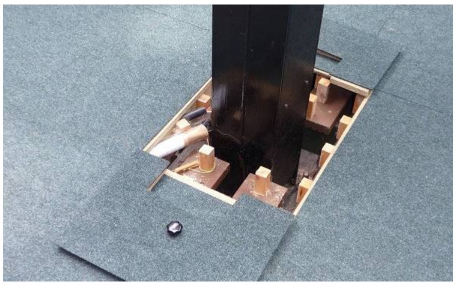
A modified roll-off-roof observatory

Victor Hull

I had originally considered constructing an observatory from scratch, or employing a local quality shed maker to produce something similar to order and then adapting it. After obtaining quotes and spending time with a spreadsheet, however, I concluded that the cheapest and easiest option was to buy an observatory ready made, and in July 2010 I purchased a 14 x 8-foot roll-off-roof model from Nick Evans at Alexanders Observatories. It was apparent to me whilst Nick was installing it that I had made the correct choice, as the quality of the materials and the build were easily as good as I could have achieved myself, even if I had spent a great deal more time and money than budgeted. To date, nothing has happened to change my view, though I have added a few modifications that I had planned originally.



First I constructed a 15 x 8½-foot decking platform standing on concrete blocks which in turn stand on submerged paving slabs to spread the load. Pads of roofing felt between the blocks and the decking joists act as a damp-proof course, and the pier, in the normal fashion, does not contact the deck or the observatory floor. There were three primary reasons for installing this decking. A stream runs along the bottom of my garden, and due to the high water-table, damp would always be a problem with a standard solid concrete base and maybe even with a membrane; venting in the observatory floor and partial opening of the south flap would limit the build-up of heat during the day and allow faster cooling towards nightfall; and it would also make life just a little more awkward for insects.

A 14 x 8-foot roof would always be difficult to move manually, so I constructed a hand-operated winch from oddments and mounted it in the 'warm room'. It has always proved beneficial – especially when I am tired and cold in the early hours. Local street-lights and neighbours' upstairs window lights shine directly into the open observatory, and I therefore installed flip-up screens on the three open walls. These also provide the unforeseen but additional benefit of considerably reducing the effect of breezes on both the telescope and the observer.

A final modification was introduced with painful hindsight. After one rainy November afternoon, the evening sky cleared and I had a very successful observing session. However, in the small hours, when it was time to shut down, the roof would not move. The heavy rain had collected in the tracks, and as everything was built exactly level it had slowly run in under the closed roof. The temperature had plummeted during the night, and the water in the now exposed tracks had frozen solid. So there I was, at 3.30 am, noisily chiselling ice out of the tracks so that I could close the roof. The fitting of hinged covers on the tracks have prevented this from happening again, and have also produced the additional benefit of keeping the tracks clear of twigs, leaves, and other detritus.

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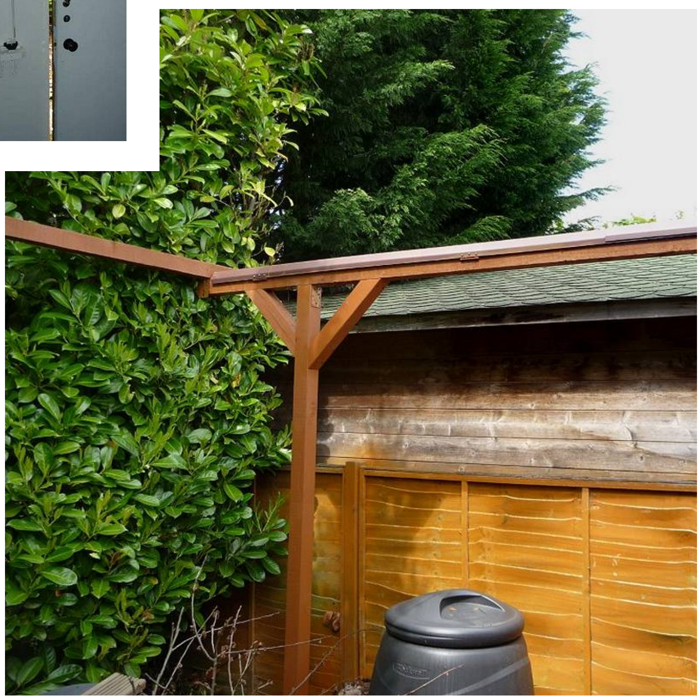

A low-cost observatory

Thomas Wakefield

My initial set-up was an EQ3 head fixed on a wooden pillar that I made myself using begged and borrowed old material. This was accompanied by a ‘dark room’ constructed from a recycled shed, end-off-line cheap decking boards to make long-lasting walls, and an old fence panel covered in roofing felt for waterproofing. The cost was little more than £100.

The next project was an upgrade from the wooden pillar and was rather more expensive – around £500. It took a little longer to complete, however, as I waited for bargains and end-of-season sales of decking boards. As I am mainly occupied with solar observing, and as I am surrounded by houses and my sky view is limited, I did not need a large sliding roof nor anything too sophisticated – just a larger ‘dark room’. The observatory was therefore tailored accordingly, with a simple metal runner system sitting on well-greased wooden tracks. It houses an NEQ6 and pillar mount with a 60-mm Coronado double stack and an 80-mm refractor for white-light and lunar imaging. I use the main shed for early-morning work and a small shed situated at my parents’ house for observing during the late afternoon.

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