The Great Melbourne TELESCOPE

PHOENIX

Astronomical Society of Victoria (A.I.N. A0002118S)

Issue 11 - April 2015

Preliminary Assembly on the New Frame!

Here are the major GMT components, artfully arranged by Matilda Vaughan and photographed by John Robinson. The Cube and Southern Cone are bolted together, with upper and lower bearings in place, and mounted on the new (grey painted) frame.

The frame was designed by members of the GMT team, our drawings verified and improved by Beca (who donated their time), and then the frame was built using funds from our Copland Foundation grant (see issue 8).

Above this assembly, the overhead crane suspends in their proper relative position (we cannot fix them yet) the Boilerplate and Lattice parts of the Main Tube. Then the whole show is floodlit, and reflected in the historical speculum-metal mirror. More of John's photographs on the next page!

Here, our hard-working and very confident qualified crane dogger, Mr Graeme Bannister, is testing the security of the crane fastenings. Below, Steve Roberts and Barry Cleland admire the Cube, Southern Cone, Southern Bearing, Quadrant, Bell Housing, with Declination Friction Relief disk and levers, assembled and mounted on the new supporting frame.

Notes and News

The 150th anniversary of Melbourne Observatory

Figure 2. Members of the Astronomical Society of Victoria set up telescopes for public viewing alongside the original South Equatorial and Photoheliograph houses dating from 1874.

On the weekend of 2013 November 23–24, festivities were held at Melbourne Observatory to celebrate its 150th anniversary. A historical re-enactment was performed with many people dressed in period costume. Speeches based on contemporary records were delivered with appearances by the Governor of Victoria at that time, Sir Henry Barkly, and the first Government Astronomer, Robert Ellery (Figure 1). The event was hosted by the Royal Botanic Gardens and the Astronomical Society of Victoria (ASV) and fronted by the author and astronomy lecturer, Prof Fred Watson of the Australian Astronomical Observatory. I happened to be visiting Melbourne and so went along on the Saturday to witness something of the spectacle and to meet some of our further-flung BAA members, especially friends Barry Adcock and Barry Clark.

It should be remembered that by the time of the founding of the BAA in 1890, Melbourne had grown to become the second largest city in the British Empire numbering some 490,000 inhabitants, and remained Australia's capital until 1927. Almost from the outset, the Observatory was a vital part of Melbourne's development and contributed to the smooth running of industries ranging from shipping to farming, from city business to politics. The observatory is famous for the Great Melbourne Telescope, which remained the world's largest equatorial-mounted reflecting telescope from its commissioning in 1869 through to 1889. Robert Lewis John Ellery held the post of Government Astronomer from 1860 to 1895. By the 1870s, he and his staff had established intricate timing instruments, kept accurate by observations of stars crossing the meridian, and transmitted accurate time by telegraphic wire to city time balls, clocks, railway stations and ships. Ellery was one of the early members of the BAA having been elected on 1892 February 24.

Figure 1. Re-enactment of the opening speeches by Robert Ellery and Sir Henry Barkly (the microphone is a modern adornment!).

The South Equatorial and Photoheliograph houses were constructed in 1874 primarily to enable observations of the forthcoming Transit of Venus of 1874 Dec 09. Thanks to some key members of the ASV, the original instruments have been conserved as part of Australia's astronomical heritage. Much of the thanks for this belong with Dr Barry Clark, who joined the BAA more than 55 years ago and who in particular has played an important part in saving the unique 4" [101mm] Dallmeyer photoheliograph.[1] On the day, several ASV members assembled small telescopes alongside the two observatory buildings (Figure 2) so that the public were able to observe the planet Venus, which was high in the daytime sky. Guided tours were held at frequent intervals for people to view the South Equatorial 8" refractor made by Troughton & Simms, together with the original automated punched tape timing equipment and synchronising pendulum clock still in working order, as well as the photoheliograph (Figure 3).

Barry Adcock is a fairly frequent visitor to the UK. We last met in London during the 2013 European Planetary Science Congress when he invited me to visit him at his home in Melbourne, so I was very pleased to be able to take up his offer during my trip down under last November. Hidden from view behind his suburban single-storey house stands a domed observatory, the principal instrument of which is a 14" [355mm] aperture f/20 unobstructed Schiefspiegler reflector all of which, including the optics, was built by Barry himself. (Figure 4). He also constructed a siderostat feeding an 8" f/30 refractor with a fixed eyepiece in the basement of his house – we viewed Venus through it while I was there.

Figure 3. Dr Barry Clark explaining the operation of the Dallmeyer photoheliograph to an attentive audience.

Figure 4. Barry Adcock in front of his observatory containing a 355mm f/20 Schiefspiegler tilted reflector and 152mm short-focus fluorite refractor. *Inset:* Mars imaged on 2003 August 19 at 12:37 UT (CM 234°) using the 355mm scope and Philips ToUcam Pro camera.

Both Barry Adcock and Barry Clark are involved in the Great Melbourne Telescope (GMT) Project, having been on its Coordination Committee since its formation in 2008. The GMT was relocated from Melbourne to Mt Stromlo in 1946 but the disastrous 2003 Canberra bushfires destroyed all of the modern equipment on and around the telescope, whilst fortuitously leaving the original large iron castings of the mount relatively unscathed. Many of the original parts discarded during successive modernisations had already been collected by Museum Victoria. The project to restore the telescope and reinstate it in its original building at the Melbourne Observatory site is being coordinated by the ASV, Museum Victoria and the Royal Botanic Gardens and is a major undertaking. I look forward to watching the project take shape in the near future.

Figure 5. The working end of Barry Clark's 71cm aperture f/3.6 '*Compulsion*' telescope.

Following my trip to Barry A.'s home, we popped over to Dr Barry Clark's house nearby, alongside which on a patch of open ground stands his observatory dome housing a very fine 28" [71cm] aperture f/3.6 reflector on a Dobsonian mount (Figure 5). I was especially impressed by the spectrograph constructed by Barry C., which he has attached to the eyepiece end of the 'scope. Barry Clark's first involvement with the Melbourne Observatory dates back to 1954 when he first started using telescopes there. In 1957, he became a demonstrator at the observatory and thus began his association with the Dallmeyer photoheliograph and many of the other early instruments.

Like Barry Adcock, Barry Clark is a very capable telescope maker having begun his career as a mechanical engineer, later becoming involved in optics of various kinds.[2] Both Barrys are committed to restoring the Great Melbourne Telescope in its original location and the GMT Project is now well underway thanks to their efforts and those of many other volunteers including Jim Pollock of the ASV.

Progress can be followed on Twitter (**https://twitter.com/GMT21stC**) and by way of the *PHOENIX* newsletter (**http://www.asv.org.au/greatmelbournetelescope.php**).

Richard Miles

References

1 Clark B. A. J. & Orchiston W., 'The Melbourne Observatory Dallmeyer photoheliograph and the 1874 transit of Venus', *J. Astron. Hist. & Heritage*, **7**, 44–49 (2004)

2 Hughes, P. K. *(ed.)*, 'A Festschrift for Barry Clark', *DSTO Aer.& Maritime Res. Lab., Melbourne, Rpt AR-010-998,* 1999. Available online at: **http://www.dsto.defence.gov.au/publications/2120/DSTO-GD-0211.pdf**

Burra, South Australia

The Great **Melbourne** TELESCOPE

by Steve Roberts

In preserving, restoring or reconstructing the parts and whole of the Great Melbourne Telescope, we have accepted and are carefully following the principles of the **Burra Charter** for the repair of historic structures. What is that?

The Burra Charter was adopted at a meeting of ICOMOS (International Council on Monuments and Sites) at the historic township of Burra, South Australia in 1979 - why have a meeting somewhere dull when you can hold it at a cute little place like Burra? - and is basically identical to the ICOMOS Venice Charter (another cute place!), with changes to accommodate the Australian environment. Wikipedia has good explanations, and links to these and further documents.

I happened to pass through Burra on a recent trip into the bush, so here's some pictures. It is a lovely, quiet old town, with well restored and preserved 19th-century buildings. There are a couple of second-hand bookshops, and a very good cafe.

A huge copper mine operated here once, and is the reason for the town's erstwhile prosperity. Exhibited on the main street is the unique "Jinker" transporter, a mighty wooden juggernaut especially made for shifting a particular 17-ton piece of mining machinery. It was drawn by 40 bullocks with six men driving, and it took three months to travel 100 miles.

Upcoming Optical Design Workshop!

by the GMT Management Committee

A two-day workshop will be convened on April 22-23 to review the proposed design of the telescope's optics, and move towards a formal specification.

Once that is written and reviewed, we can proceed to seek funding, and then to order the (expensive) mirror set.

The optical design will affect the positioning of apparatus near the top of the restored telescope's main tube, among other physical attributes.

The workshop will be chaired by our good friend and supporter **Professor Fred Watson**[*], former Astronomer in Charge of the AAO at Coonabarabran.

Attendees will include MV directors and staff involved with the project, the GMT restoration team and leading ASV committee members.

The tentative program will be as follows.

April 22, starting at Moreland -
- Arrivals and introduction;
- Tour of the workspace;
- Handling of the physical parts

Morning tea, and move to Melbourne Museum

Formal sessions at Melbourne Museum -
- Project overview;
- MV/ASV/RBG/BoM partnership;
- Burra Charter principles;
- Report of progress of restoration to date

Using the Restored GMT -
- Who will be using it?
- Public programs
- The Visitor Experience
- Typical objective for public viewings
- Use for research and by ASV members

The Proposed Optical Design -
- Why change from the original design?
- Focal ratios and apertures of the lenses and mirrors
- Preferred material for the mirrors
- Mirror surface coatings

Implementation of the Optics -
- Flotation system for the primary mirror cell
- Active or passive heating/cooling systems
- Tube properties, optical baffles and stops
- Recommended eyepieces
- Bought eyepieces, or custom made?
- Auxiliaries - filters, camera, finder scope

April 22, 6:30pm - Carlton/Fitzroy area
Dinner *(sponsored by a generous donor)*

April 23 - continuing at Melbourne Museum
- Review of previous day's discussions
- Will the proposed optics perform against the typical viewing objectives?
- Refinement of optical design
- Further investigations and follow up

Commissioning the optics -
- How to select a contractor for the optics
- Contract procedure and management
- Independent testing
- Formal process of acceptance

Conclusion
- Statement of outcomes
- Write up

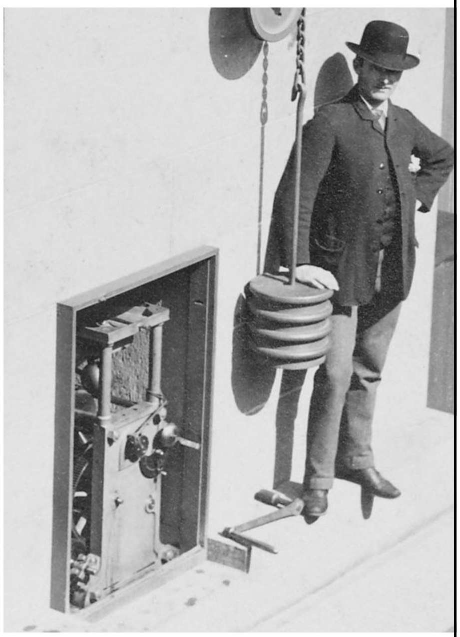
---

* Fred says he has spent so much time inside observatory domes that he is starting to look like one! He also sings - endure him at: https://www.youtube.com/watch?v=k82nIvIGGUY

On the Trail of the GMT Driving Clock

By Jim Pollock

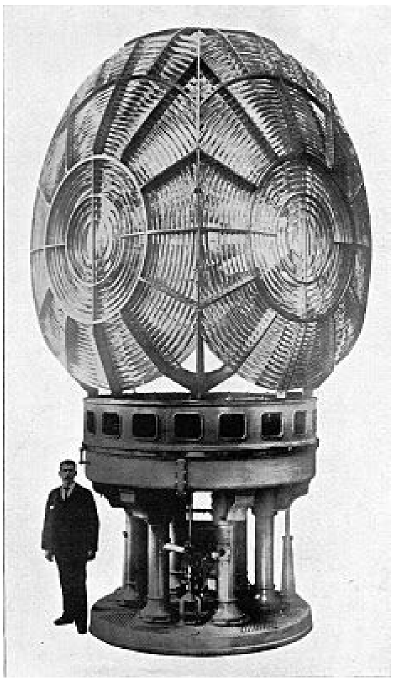
The list of the lost pieces of the Great Melbourne Telescope includes the clockwork driving mechanism that was used to drive the polar axle of the telescope. When in operation, the rotation of the Earth had to be exactly countered by the rotation of the polar axle, so that the objects in the eyepiece remained "fixed" in the telescope's field of view.



The GMT Driving Clock in the Alcove in the Southern Pier (this is a blow up from the big picture of the GMT in the 1870s.)

The driving mechanism was powered by a descending weight which had to be rewound periodically, similar to the workings of a grandfather clock. The speed of rotation was controlled by a rotating centrifugal governor. Similarly controlled clockwork systems are used to power the ASV's 12-inch reflecting telescope and the Victorian government's 8-inch equatorial refractor at Melbourne Observatory.

Unfortunately, over the years, the original driving mechanism has been lost. We are planning to drive the refurbished GMT with a carefully hidden electric motor, but for conformity to the Burra Charter we would like to reproduce the original clockwork drive, as in the photo here.



The optical system of a large Chance Bros. lighthouse mechanism. The mercury flotation bath is level with the man's head. The driving clock is located centrally below the mercury bath. (Source: Wikimedia Commons)

Grubb may have made the clockwork drive in-house, or may have bought it "off the shelf" from a specialist maker of turret clocks - or of lighthouse equipment, since a lighthouse needs a similar slow rotation of its lenses. Although it was a long shot, we investigated this latter course in the hope of saving considerable effort, and to help fill in gaps in our knowledge of Victorian precision engineering practice, especially in relation to gear design and manufacture.

The greatest manufacturer of lighthouse equipment in the second half of the 19th century was Chance Bros. of Birmingham. They manufactured the giant Fresnel lenses that concentrated the light from the source at the top of the lighthouse into a narrow beam. They also manufactured the optical glass from which the Fresnel lenses were made. The frame which held the lenses floated on mercury - an almost frictionless bearing. The mantle that provided the light was often powered by kerosene vapour or acetylene, rather like a giant Tilley lamp.

Chance Bros equipped most of the lighthouses around the Australian coast as well as throughout the British Empire (the Fresnel-lens apparatus depicted above was for a lighthouse in Karachi) and other countries throughout the world. Their equipment was of an exceptionally high quality. They certainly had the engineering capability to supply a driving mechanism for the GMT.

By a stroke of luck, further searches on the Internet have revealed that Chance Bros. Lighthouse Engineers has an office in Collins Street, Melbourne. The GMT restoration group has made contact with them, and they have agreed to follow up our request for help. At the same time, we have made contact with Toby Chance, one of the Chance family, and the co-author of *Lighthouses: The Race to Illuminate the World,* who also may be able to help. If the original GMT driving mechanism was actually made by Chance Bros., it might be possible that engineering drawings of our particular model are still in existence. A copy of such plans would make the reproduction of the driving mechanism a far simpler task.

In the meantime, the restoration team is checking to see which Victorian lighthouses still have their original clockwork drives. This may give us the opportunity to inspect a Chance Bros driving mechanism at close quarters, which would be interesting in itself.

Speculum Metal, and the GMT Mirror

By Jim Pollock

Until the middle of the 19th century, the most common method of producing blanks for telescope mirrors was to cast them from speculum alloy - a type of bronze having about one-third tin and two-thirds copper, with a little arsenic oxide to improve the alloy's hardness. More copper gives the reflected light a yellowish tinge, while more tin imparts a bluish tinge. Although the alloy is hard and heavy, it is also brittle and difficult to work.

Speculum metal takes a reasonable polish but its surface reflects only 66% of the incident light, whereas modern reflecting surfaces of over-coated silver or aluminium reflect more than 98%. Since reflecting telescopes usually employ two mirrors, a telescope with speculum mirrors would deliver 66% of 66%, or only 44% of the light falling on the primary mirror. Speculum metal also has an unfortunate tendency to tarnish in a humid atmosphere.

In 1856-57, Steinheil and Foucault discovered methods of chemically depositing a thin layer of silver on a glass surface. This discovery, along with improved methods of casting and annealing glass in the 1880s rendered the use of speculum obsolete. A.A.Common's 36" silver-on-glass reflector was constructed in 1879 at Ealing in west London, and this was followed ten years later by Common's 60" reflector, also made in Ealing. That telescope was sold to Harvard College Observatory in 1904.

Speculum mirrors were used in telescopes for 200 years, from Isaac Newton's first successful reflector of 1668 with its primary mirror only 33 mm diameter, to Lord Rosse's giant reflector of 72" (1.8 metre) aperture in 1845. The mirror of this great telescope is on exhibition in the Science Museum in South Kensington in London. The last large speculum mirrors ever made were probably the two primaries for the Great Melbourne Telescope, in 1868.

Casting mirror blanks of speculum alloy was a tricky business. The usual practice was to melt the copper in a crucible, add the tin and then cast the alloy into bars. These were later melted again for the actual casting of the blank. Once the molten alloy had been poured into its mould and had solidified, the red-hot blank had to be moved to an annealing oven where it was allowed to cool very slowly (several weeks!) so that no internal stresses remained.

The contract for the construction of the Great Melbourne Telescope was signed with Grubb of Dublin in January 1866. The Grubbs - Thomas and his son Howard - were the greatest telescope makers of the day. As well as constructing the telescope and its equatorial mounting, it was decided to make *two* primary mirrors, so that one could be in the telescope for observations while the other was being re-polished and refigured, allowing the telescope to remain in service without much downtime[1].

The mid-19th century was the era of the great amateur astronomers[2]. Thomas Grubb had collaborated with Lord Rosse in the construction of his massive 72" (1.8 metre) reflector. James Nasmyth, the great Scottish engineer, had been casting speculum mirrors as a boy in his bedroom in Edinburgh since 1827. By 1840, he had cast and polished a 10" diameter speculum mirror which, when shown to his great friend and another amateur, William Lassell, "made his mouth water." Nasmyth also cast and polished mirrors for his "excellent friend" Warren De La Rue.

In the case of the blanks for the Great Melbourne Telescope, casting operations for the first blank commenced on 2 July 1866. After 13 hours, the crucible, capable of holding one and a half tonnes of alloy, was at red heat and charging of the crucible commenced. By 8.30pm on 3 July and after a number of setbacks, 27 cwt (1,370 kg) of alloy was molten and shortly after, the blank was poured in a process taking only six seconds.

The casting process utilised Nasmyth's method of initially inclining the mould at an angle of about 20°, then quickly returning it to the horizontal as the molten alloy filled the mould. After cooling slightly, the still red-hot casting was removed from the mould, dragged into the pre-heated annealing oven and allowed to cool very slowly over the next 24 days.

The first casting was imperfect, so the Grubbs poured a second blank on 22 September 1866. Various improvements were made to the mould and the pouring of the molten alloy, which this time took a leisurely 16 seconds. The result was a perfect casting. A third blank was poured two months later, on 24 November 1866.

The blanks were then ground and polished on a machine devised by Thomas Grubb. This machine is also currently undergoing restoration at Moreland, and we hope that it will also be displayed, working, at Melbourne Observatory.

It is often stated that the Great Melbourne Telescope was a failure. Professor George Ritchey of Mount Wilson Observatory in California described it as "…one of the greatest calamities in the history of observational astronomy…". But as far as we know, Ritchey never came to Melbourne and never looked through the Great Melbourne Telescope. Certainly, the observations that were published were limited but this was due mainly to insufficient funding by the Colonial government, the effects of the economic depression that hit Victoria in the 1890s and the commencement of the Carte du Ciel and Astrophotographic Catalogue surveys by Melbourne Observatory that began in 1889. There were allegations that the paucity of published observations was due to poor quality of the instrument; this was certainly not the case, as the GMT was known to have delivered some very fine images at the eyepiece.

1 Of the two original speculum mirrors of the GMT, one was smashed during its early days at Mount Stromlo. The money generated by the sale of its broken pieces reportedly helped to pay for the replacement 50-inch Pyrex mirror, made by Sir Howard Grubb, Parsons & Co. in the 1950s. The remaining speculum mirror - see page 1 of this issue - is very historic and valuable, and for other reasons unsuitable for use in the refurbished Great Melbourne Telescope.

2 Lord Rosse, James Nasmyth, William Lassell, Warren De La Rue and "several of the brightest names of British science" were heavily involved in investigating the feasibility of establishing a large telescope in the southern hemisphere, and/or in directing the building of the Great Melbourne Telescope by Thomas Grubb.

Significant Contribution by Horologists

Barry Clark gave a talk about the Great Melbourne Telescope to the Victorian Branch of the **Australian Antiquarian Horological Society**. Here he is at their meeting, with one of his slides - a particularly brilliant one, of course. Vivian Kenney, President AAHS, gave a vote of thanks.

It was interesting to attend this AAHS meeting and to meet the various horologists, who exhibited various mechanisms they had made and clocks they had made or restored; these masterpieces of clockwork and delicate light-mechanical engineering can be seen on their web site. One member turned up 10 minutes late, carrying a novel clock ... but nobody is going to buy that clock, eh?

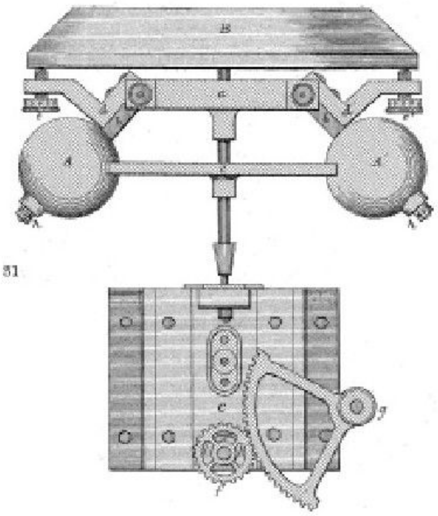
Vivien told the story of the installation of the tower clock at Southern Cross Station. This large timepiece once sat on top of the (then) Spencer St Station building, and was a major Melburnian landmark. It then stood for some years, on its tower, at the Scienceworks complex at Spotswood. Now, after restoration by AAHS to its original appearance and in good working order, it has been brought back to the railway station, but now it's *inside* the station, and its tower is shortened and (in this modern age) is festooned with moving advertising displays. When the clock was being set in place, in the middle of the night involving some very delicate work with a crane, executives observing the process were exclaiming “Be careful, don't damage the adverts!”.

In an active spirit of collaboration with ASV/MV/RBG, the AAHS has already refurbished the driving clock (originally designed by Grubb) for the South Equatorial Telescope at Melbourne Observatory.

The photograph below, taken by Barry Clark in 2013, shows AAHS President Vivian Kenney inspecting this mechanism after its reinstallation. Note the twin-ball governor mechanism; the GMT clock had a similar arrangement.

Now, the AAHS have most generously offered to make a replacement for the "clock" mechanism that drove the GMT; this has been wholly lost. It is **not a clock** that tells the time, rather, it is the source of a very steadily rotating shaft that with suitable gearing will rotate the telescope exactly against the Earth's rotation, making the stars appear to be stationary. A separate gearbox, also lost and needing to be restored, slightly reduced the shaft speed so as to match the Moon's orbit around the Earth.

Fig. 31



A telescope drive cannot use an escapement like most other clocks, because that would drive the shaft in discrete little steps; what is needed is a constant, steadily powered drive. The original GMT mechanism had an ingenious rotating-ball governor, drawn in an 1869 journal and shown above, that could be adjusted to give sidereal rate at the telescope. The rate could also be varied slightly. The telescope was driven by a worm gear meshing with a brass-toothed segment (above) which has survived in the Museum's care; the segment, being only 1/12 of a circle, allows for only two hours of continuous driving.

The Clockwork Driving Weight

by Steve Roberts

The clockwork driving mechanism was powered by a falling weight that would have had to be wound back up from time to time, with the mechanism uncoupled and therefore the telescope locked in place. The mechanism was designed to work for two hours maximum (the brass segment is 1/12 of a circle).

Our searches in the contemporaneous literature indicate that the GMT driving mechanism has been operated with driving weights of 90.1, 127.0 and 180.2 kg at Dublin, and maybe 90.1 kg followed by 118.2 kg at Melbourne. Only one article mentions the power required to run the GMT, as being 2500 ft-lb per hour, but it does not state which driving weight that applied to. Converting to trendy SI units, the GMT's drive power was only 0.94 watt[*], and most of that power would normally be dissipated by friction in the governor. This figure looks very low, until we remember that ordinary mechanical clocks and watches run at powers typically in the microwatt to nanowatt range.

We once suspected that part 3830 (formerly designated part 66) was the driving weight for this purpose, but now we think it was for the polar axis friction relief system. We have no pictures showing the driving weights in Melbourne, but if this solid metal block was used to drive the telescope it would have to be a later substitute. Look at the picture of it below, or rather ... don't! We would expect the original weights to have been more elegant, but we don't scientifically *know* that they were elegant; the *Illustrated Australian News for Home Readers* of 7 August 1869 stated: "In one corner of the room is the well for the weights of the telescope clock, and ponderous looking things they are." This is clear evidence that it was not a single weight. And, with reference to the Burra Charter, we can now draw up a brief check list of the required attributes for GMT Driving Weights:

- Total mass of about 500 lbs?
- Look ponderous?
- Exist as a plurality?

Readers may recall that in issue #4 of PHOENIX we asked for guesses of the weight of this metal block[**]. Its specific gravity is about 5.9, showing it to be made of iron, not lead, and it weighs (when in Melbourne) 229 kg[***] - evidently it was designed to be 500 lbs. So, for it to drive the GMT for two hours, an Imperial descent of 10 feet would have been required; this cannot have been achieved without making a hole in the floor. Indeed, a contemporaneous journal article refers to such a hole, with a well dug into the ground beneath it; but the GMT house's floorboards and the earth below show **no sign of such a hole or well** ever having existed. More in next issue!

* Or 5.091 kiloacre-ounces per pole-fortnight

** Tony Dunning won the wire brush prize; but Barry Clark estimated the *mass* of part 3830, and gave helpful formulae for how its *weight* would vary with the Earth's gravitational field, or if it were on Pluto, etc.

*** Due to removal from the centre of the Earth it would weigh less at the top of its travel than at the bottom - 216 mg less, approximately. But then the reduced density of the displaced air, 10 feet higher off the ground would *increase* its apparent weight by 59 mg. Then there are gravitational anomalies, and magnetism to account for; and the dust that would settle on the weight, the ablation of metal when the dust was brushed off, etc.

Steve's Adventures in CANBERRA

30 May 1431:

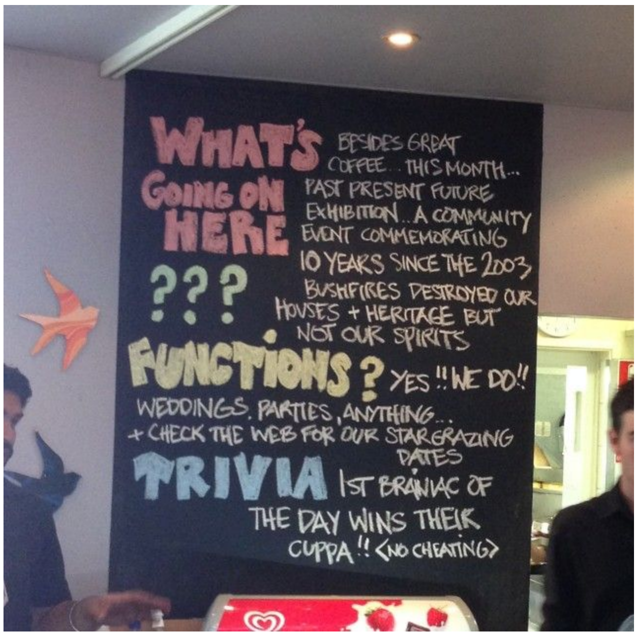
"And who are you?" she sternly spoke
To the One beneath the smoke
"Why, I'm Fire" he replied
"And I love your solitude - I love your pride"

I saw her wince, I saw her cry,
I saw the glory in her eye.
Myself, I long for love and light,
But must it come so cruel, and oh so bright?

Twelve years have now passed since the disastrous fire that destroyed the most recent incarnation of the Great Melbourne Telescope.

Recently I went back to Mt Stromlo, on a very emotional personal journey.

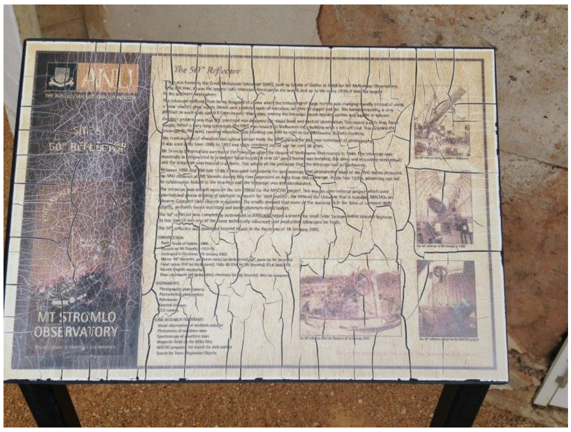
I began at the cafe, where this little gnome is displayed with pride, although he's lost his colour. You and I may have been here and there, but he's been all the way up to 500ºC and back down again.



The observatory walls survived, but the dome of course was completely melted. The building has been "sort of" restored - painted, and given a new door and new windows, but these are to keep people out. A new dome would be a suitable addition to the building, and maybe a telescope, oh yes, but it is not going to happen here; the Stromlo site is now considered to be fully refurbished and what is left in ruins, will stay in ruins.

Inside the shell of the observatory, the concrete piers are all that remains here of the GMT. There is, however, a new brightly coloured gnome in the alcove on the left. Good luck, son.

The two images on the next page show the modernised telescope as it stood in 2008, five years after the bushfire; you can see the Cube, Southern Cone and Bell Housing, all roasted and spattered with molten aluminium. These original Grubb parts, made in Dublin in 1868, have survived the fire in robust condition. The lower (northern) cone and all the furnishings left and right of the Cube were Stromlo additions of the 1950s and 1990s. All of this flimsy 20th-century stuff was damaged beyond repair.



Some of the bigger damaged 20th-century parts have been left behind at the site, for children to play on. The explanatory sign was made after the bushfire, it has cracked from exposure in the Canberra summers and winters. The text on the sign is a good history of the Great Melbourne Telescope:

The 50" Reflector

This was formerly the Great Melbourne Telescope (GMT), built by Grubb of Dublin in 1868 for the Melbourne Observatory. Ar the time, it was the largest fully-steerable telescope in the world, and up to the early 1950s it was the largest in the southern hemisphere.

The telescope suffered from being designed at a time when the technology of large mirrors was changing rapidly. Instead of using a "new" silvered-glass mirror, Grubb used a mirror made of speculum - an alloy of copper and tin. This tarnishes quickly, is very difficult to work with, and is 6 times heavier than glass, making the telescope much heavier, costlier and harder to balance.

Another problem was that the telescope was designed for visual (look and sketch) observation. This meant a very long focal length, hence a very long telescope. The GMT was housed at Melbourne in a building with a roll-off roof. This exposed the telescope to the wind, causing vibration. This building can still be seen in the Melbourne Botanic Gardens.

The combination of vibration and optical design made the GMT useless for the new technique of photography. It was used only from 1869 to 1893 and then remained out of use for over 50 years.

Mt Stromlo Observatory purchased the telescope after the closure of Melbourne Observatory in 1944. The telescope was drastically re-engineeered to a shorter focal length [from f/42 to f/18]. A new 50" Pyrex mirror was installed, the drive and mounting were rebuilt and the telescope was housed in a dome. This solved all the problems that the telescope had in Melbourne.

Between 1956 and the late 1970s it was used extensively for spectroscopy and photometry. Most of the PhD theses produced by ANU students at Mt Stromlo during this time depended on data from this telescope. In the late 1970s, advancing age led to catastrophic failure in the bearings and the telescope was decommissioned.

The telescope was rebuilt again [as f/5.6] in the late 1980s for the MACHO project. This was an international project which used gravitational microlensing of starlight to search for 'dark matter', the 90% of the Universe that is invisible. MACHOs are Massive Compact Halo Objects in galaxies. The results showed that some of the material is in the form of compact dark objects, probably burnt-out stars and loose planetary-sized bodies.

The 50" reflector was completely automated in 2000 and began a search for small Solar System bodies beyond Neptune. At this time it was one of the most technically-advanced and productive telescopes on Earth.

The 50'" reflector was damaged beyond repair in the firestorm of 18 January 2003.

And well, yes, THAT 50” reflector was damaged beyond repair.

But the 48” Great Melbourne Telescope of 1868 is rising from its ashes.

It will look identical to something made in Ireland in 1868. However, like all of its former incarnations, the Great Melbourne Telescope will yet again be a modern instrument, this time with up-to-date 21st-century optics. It will again gleam as a touristic jewel of its original home, Marvellous Melbourne.

On this visit to Mt Stromlo I also saw the wreckage of the Oddie Telescope, an instrument that I frequently observed with when I lived in Canberrra. Both it and the modernised GMT were completely ruined; the devastation was appalling.

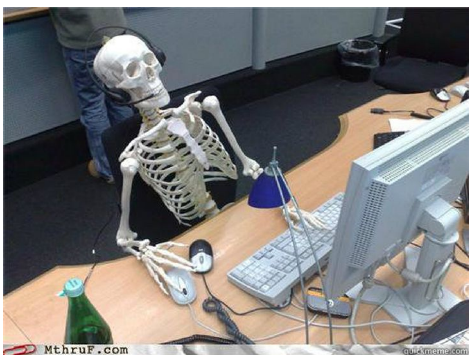
Excuse me.

GMT TWITTER FEED

MV are maintaining a **Twitter feed** for the GMT project. An update (a 'tweet') is posted nearly every day, so the coverage is far better than PHOENIX! Well worth following - go to

`https://twitter.com/GMT21stC`

You do <u>not</u> have to be a subscriber of Twitter to read the updates!



PHOENIX, issue 11

Written (except where noted), edited, laid out and issued (eventually) by Steve Roberts, for the GMT Restoration Project

PLEASE DISTRIBUTE THIS WIDELY! You can download this issue **and all the back issues**, freely, from these sites:

www.asv.org.au/greatmelbournetelescope.php

www.greatmelbournetelescope.org.au/newsletter