

# Phoenix

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

Issue 1 – June 2009

## The Great Melbourne Telescope Project

Hello! This is the first in a proposed series of newsletters, intended for everyone interested in the project, and especially the ASV volunteers. Each issue, as a PDF file issued by ASV probably every three months, will describe the work recently done, and look forward to the immediate future. A collection of all issues should form a complete history of the restoration project.

The current situation is that all available parts of the GMT have been gathered together at Museum Victoria's storage premises, and that hands-on work is about to begin. More of this anon, but as this is the first issue and we have only just begun to *look* at the physical parts on hand, let me (editor:

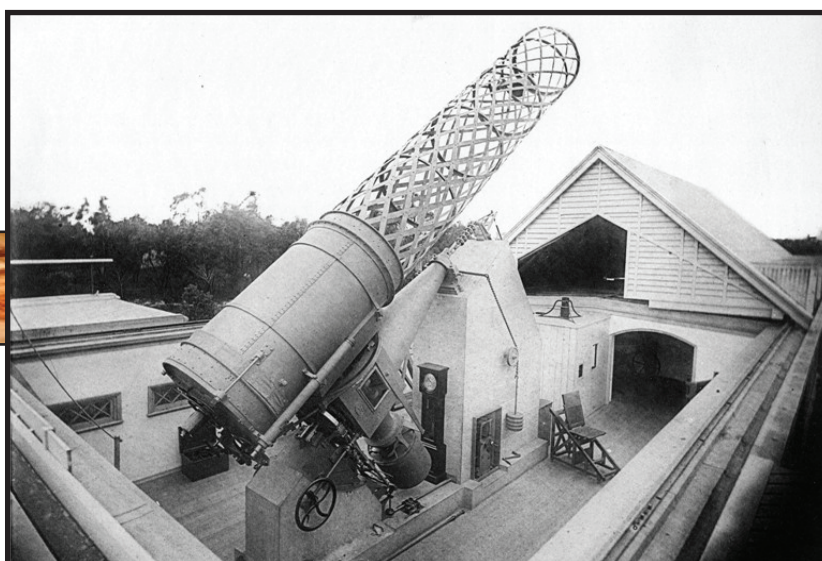
Steve Roberts) outline a very brief history of the GMT. Fact Sheets are being prepared, with some of the following information expanded to a full page of nicely laid-out A4; these will be incorporated in a GMT website, now being planned.

### ORIGIN AND EARLY YEARS

To fulfil the scientific need to explore the southern sky, and having a suitable politically and physically accessible location, the young and newly wealthy Victorian Government decided to commission the world's biggest steerable telescope, for use at the Melbourne Observatory. The Great Melbourne Telescope, as it was soon known, was built in

Dublin in 1867-68 and shipped to our shores after testing. For some decades, the telescope was an engineering marvel of its time, as indeed was its bluestone-based observatory building, which had a roll-off roof of novel design.

The world expected great discoveries from the GMT. It did reveal marked spectral changes in the blue supergiant eta Carinae, and it allowed the first-ever observation of the spectrum of an extragalactic nebula. Its photographs of the Moon in the 1870s were of world class, and it made one of the first photographs of the Orion nebula in the 1880s. But most of the GMT's time was spent in visual observations of nebulae, especially "southern nebulae".



*This photograph, taken in about 1885 shows the original Great Melbourne Telescope, at the Melbourne Observatory. That's not real Melbourne weather in the sky, it's foxing in the emulsion. Note the 3-foot windowed cube in the middle of the mount and the conical polar axis – these are referred to later.*

Sadly, after the financial crash of the 1890s, the Melbourne Observatory was never again given enough resources to allow the GMT to be put to scientific use. In 1946 the telescope was sold to the Mt Stromlo Observatory, near Canberra, where it was housed in a new domed observatory, given a new mirror and then heavily modified to serve various modern research projects. The world's biggest (at the time) CCD array was later installed – 8 panels each 2048x2048 pixels - and in 1993 the GMT was used to derive the world's first observations of MACHOs (massive astrophysical compact halo objects) – a minor form of “dark matter” detected by gravitational lensing. In 2000, to look for trans-Neptunian objects, the telescope was completely automated, becoming one of the most technically-advanced and productive telescopes on Earth.

Like the other telescopes at Stromlo, the GMT (which they referred to as the “50-inch”) was damaged beyond economic repair by the Canberra bushfires

of 2003. Specifically, burning embers from the surrounding forest landed upon the dome, then radiant heat and the firestorm wind heated the dome to a cherry red heat and thoroughly cooked everything inside, up to at least 500°C. The aluminium dome itself is believed to have caught fire. The telescope's Pyrex glass mirror was shattered and its steel struts were softened, causing parts of the structure to sag. Only bent metal and broken glass remained. The wreckage, having heritage value but no longer any scientific value, attracted little attention in Canberra's post-bushfire reconstructions, and was left outdoors for five fierce summers and six snowy winters.

Although repairs were technically out of the question, when heritage and historical issues were brought to bear it

became clear that a volunteer project, together with new optics, could reconstruct the GMT and perhaps restore all of its former glory, while still preserving its heritage value.

Jim Pollock, Barry Clark and other ASV identities talked with Mt Stromlo management and Museum Victoria, which already possessed many discarded original parts of the GMT that had been sent back, unwanted at Mt Stromlo. Jim and others travelled to Canberra several times to establish the feasibility of the project. In November 2008, in a carefully planned joint operation under the auspices of Museum Victoria, with the Australian National University, the Australian War Memorial (who have experience of moving heavy objects), Mt Stromlo management, and ASV representatives, the bent and

mangled original pieces of the telescope were skilfully separated, loaded onto trucks and brought back to Melbourne, where they are now being very carefully curated in Museum Victoria's store.



*This photograph breaks my heart. The mirror cell is supposed to line up with the square holder and the top end.*



*Here's the cubic casting of the polar axis that held the declination axis, starting its journey back home to Melbourne. The upper (southern) conical part is original; the lower conical part was added at Mt Stromlo.*



*This is the shattered Pyrex mirror, in the original GMT mirror cell– those struts were once straight. And that's Jim Pollock, wondering how we are going to restore it. But we will!*

## ORGANISATION OF THE REPAIRS

Long before this operation, which took some months to coordinate, extensive talks were being held between the three organisations that would be involved in the restoration:

- **Museum Victoria** (ownership, resources, professional advice)
- The **Astronomical Society of Victoria** (optical and engineering skills; volunteer labour)
- The **Royal Botanic Gardens** of Victoria (original building, historical site, heritage issues).

A formal Memorandum of Understanding has been signed, and this collaboration will be going strong throughout the life of the project! Representatives sit on a project steering committee; the three parties MV, ASV and RBG all agree that the project needs a careful, step by step approach to test its financial and technical feasibility. The project would probably cost in excess of \$3 million. There are many challenges – technical, operational and funding - and these will have to be jointly resolved as we go along.

The Museum (acting for the people of Victoria) has ownership of all the GMT parts and will retain ownership of the completed instrument. They will make the formal decision, usually based on proposals submitted by ASV and experts that MV and ASV can call in, on whether each part will be “conserved, restored, replaced or adapted” -

- Conservation – kept in exactly the condition it is now in, whatever that takes
- Restoration – brought back into the condition it was originally in, then conserved

- Replacement – if the above two prospects are hopeless, then make a new look-alike part
- Adaptation – Apply one of the above three processes and then alter the part in some way (for some good signed-off reason, having paid due regard to its heritage value).

There are about 120 parts and assemblies of the GMT on hand at present. Some of these will resolve into smaller parts; every nut and bolt will be catalogued and tracked.

Internally, we have our own GMT Reconstruction Project body, which is a sub-committee of ASV Council. This sub-committee is chaired by **Jim Pollock**; with the “three Barries” **Barry Adcock**, **Barry Clark**, and **Barry Cleland**. We identified four areas where volunteer effort would be very useful – mechanical, optical, control/electrical, and to contribute advice to the RBG on the restoration of the GMT House, if that proves feasible. Volunteers were called for, and 57 ASV members responded - we were very moved and gratified to see such a large response! For the four areas of effort, Team Leaders were appointed - Barries Adcock & Clark for the mechanical team; **Arthur Coombs** for the optical team; **Steve Bentley** for the control/electrical team; and the building team is not needed yet. Also, **Steve Roberts** was appointed to manage the volunteers and to handle paperwork and back-office tasks - and to issue newsletters :-). The earlier report, e-mailed to all volunteers in April 2009, described this process more fully.

In case you see one of these people wandering around looking lost, this is what they look like: (well, Jim only wears a tie when he thinks he’s going to be photographed)



Jim Pollock



Barry Clark,  
with an original GMT  
eyepiece



Barry Adcock



Barry Cleland



Arthur Coombs



Steve Roberts



Steve Bentley

## WHAT HAS HAPPENED RECENTLY

The above description brings the project to the beginning of 2009. Recently (mid May 2009) the three institutions MV, ASV, and RBG held a high-powered Communications Strategy workshop, after which ASV held two internal meetings to follow it up. Out of this will come numerous things, when all agreed by the three parties: an official Project Mission Statement, posters, lecture presentations, pictures, fact sheets, a project logo, a project URL and web page, etc. These materials will all be of high quality and can be called upon for press releases or any other form of publicity, and for use in seeking funding, etc.

The ASV contingent has also been working with MV to establish the formalities and safeguards for getting work started on the pieces of the GMT. It turns out that a lot of the operational parts used at Mt Stromlo, visible with horrendous damage in pictures of the bushfire, were later additions to the original instrument. When we count in the parts that were in storage in Melbourne in 2003, we have about 90% of the parts of the original telescope, including the original 48-inch mirror, one of the last big speculum-metal mirrors ever made.

## OUR WORKING ENVIRONMENT

The Museum carefully documents, tracks and records everything in its possession. Artefacts are normally preserved in the same condition that the Museum received them in - so we will need to explain and justify the alteration of every firestorm-damaged GMT part.

Museum Victoria implements a maximally safe working environment and the strictest working procedures. In May 2009, the ASV sub-committee

and project leaders were inducted as Research Associates, allowing them to enter the Museum's premises and supervise work. The induction process took almost a full day and involved OH&S presentations and a detailed official description of the Museum's working methods, safety principles, procedures, and documentation. You can't just show up with a wire brush and start improving the Museum's artefacts!

Before any item can be modified, it must be photographed and documented "as is", and a written proposal for the work must be developed, justifying the work and stating how to determine when the end result has been achieved. A Job Safety Assessment (JSA) is also required, identifying possible hazards and how they will be controlled. When this paperwork has been approved, a start can be made on the physical work, with more photography and documentation as the job proceeds, and on completion.

We envisage that work will normally be done at the Museum's premises where all the parts are now stored; the Museum intends to provide tools, but we will bring our own specialised tools. We have yet to establish if it is feasible for us to work at weekends, or whether we will have to keep within normal office hours.

## BEGINNING THE WORK

As most of our volunteers will already know from bitter experience - or should know, by now: **Time spent in careful planning, and in ensuring high-quality work, will repay itself many times over when the actual work is done.** As Confucius may have said: "There's never time to do it right, but there will be time to do it all again". In addition, we

have the problem - no, we have the privilege - of working with components of a **priceless cultural and scientific heritage** - public property which needs to be treated with the greatest care and respect!

So far, we have not identified any timelines for the work involved in restoring the GMT, but there are numerous little jobs. Therefore ASV is drawing up a gigantic flow-chart, so that we can identify any critical paths and understand which jobs must take precedence.

The first work session was on Wednesday, 24 June 2009, when the seven inducted ASV persons attended and began to survey the stored pieces, and to establish the practicalities - such as, do we work at the storage location, or in one of the workshop areas? Do we have enough lighting and seating? Are the Museum's workbenches and tools suitable for what we need? (And where do you get lunch?) Who will do what? We don't want to have one bloke working with six admirers looking on.

It was not practicable to begin cataloguing and photographing the larger pieces - some of them, such as the telescope tube, are far too heavy to lift.

We spent some time sorting out the motley collection of nuts and bolts that were removed during shipping of the telescope in November 2008, or earlier. We placed them in compartmented storage trays - the 22-inch bolts got a tray of their own - and made a rough go at measuring them, so that we could begin making a catalogue. It is evident that bearings and shafts will need to be measured to submillimetre precision, or, more correctly, to thousandths of an inch - both Whitworth and metric threads are present among the parts on



hand. And we began to develop a file structure and database to record our results, which will have to be interfaced to the Museum's data systems.

### OUR FIRST BIG PROBLEM

Our first task is working out how to dismantle the polar and declination axes assembly, so as to allow the removal of the lower cone and the restoration of the original lower (northern) bearing of the polar axis. This assembly must have been bolted together, but it may now also be welded together, courtesy of the Mt Stromlo Forest, and it had begun to rust. After picking off the gobs of aluminium that fell from the melting dome, we will then look inside to find the internal attachment bolts, and will try to free them, using much WD-40. And carefully.

### WHAT'S NEXT

Modern engineering drawings need to be developed for everything – notably for those parts for which we have no drawings at all, and even more notably where we have neither the part nor the drawing. For those, we'll have to begin from photographs and descriptions of the originals. Some important engineering drawings were published by the Royal Society of London in 1868, but most of the GMT's engineering details

were lost in *another* bushfire at Mt Stromlo in the 1950s. I told you there'd be some hurdles!

With all parts numbered and documented in conformity with the Museum's methods, later in 2009 we expect to proceed with cleaning them up in readiness for the eventual reconstruction of the instrument, and getting replacement parts made if necessary. Much of the non-parts work (e.g. making drawings, or making new parts) could be done at ASV or volunteers' own premises, and/or at weekends. Some or all volunteers could be inducted into the Museum's procedures, but we noted that our formal induction required significant time and effort by several senior officers of the Museum; such a day may not easily be repeated. So, after we get some more experience from these first working sessions, ASV will estimate the scale and manpower for what we need to do, and start to explore these issues with the Museum.

### EVER ONWARDS - TOWARDS THE NEXT ISSUE

We hope that this newsletter and its successors will keep readers abreast of where the project is at, and what should happen next. Progress may *appear* to be moving at a glacial rate at this stage, but a great amount of liaison work has

been done in establishing the initial basis for the project, and in developing a cordial and constructive relationship between the three organisations. We can definitely work together, despite the fundamental difference in nature of ASV (amateur resources, volunteer labour) and MV and RBG (professional staff, formal methods, and good resources, but there are competing projects).

It is planned that the restored Great Melbourne Telescope will have state-of-the-art, modern 50-inch optics and will be one of the biggest telescopes in the world dedicated to public use, as well as having a capability for some useful scientific work and for use over the Internet. It is expected to become one of the major tourist attractions of Melbourne. The planning and hands-on work will not only be essential in restoring the telescope, but it should be a fun and deeply satisfying project to be involved with. We thank you all for volunteering, and will keep you up-to-date in future *Phoenixes*.

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(Layout: Richard Saunders)



*The damaged GMT at Mt. Stromlo. Note the absence of the dome.*