November 2022
Bob Crosthwaite

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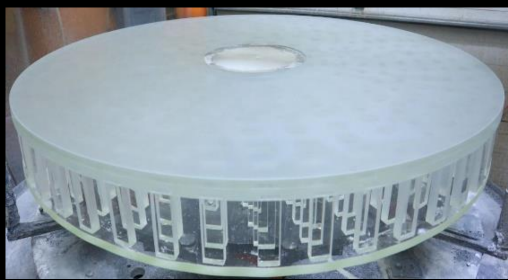
REFLECTING ON THE YEAR

2022

The Original 48” Speculum Mirror

Our new 48”’Mirror
Made out of Borosilicate



From the 1869 Speculum Mirror to the new 2022 Borosilicate mirror

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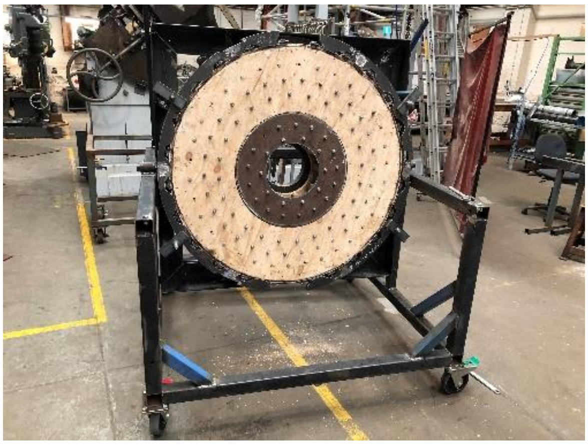
GETTING IN FOCUS

The Primary Mirror Fabrication Story

Construction of the Dummy Primary Mirror: The dummy mirror is to be used to aid positioning etc. on the main GMT structure. It therefore had to be equivalent to the new mirror, not only in size and mass but also in shape, to allow for aerodynamic testing..





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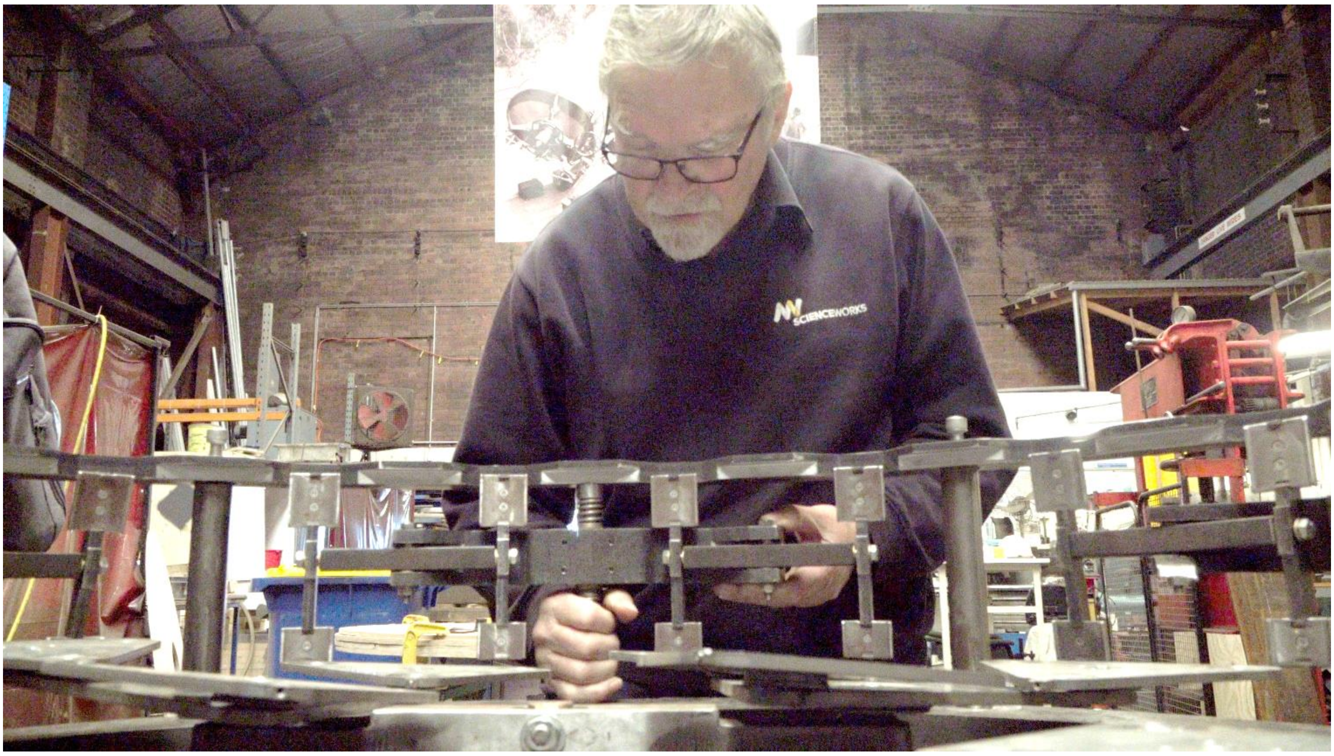
GETTING IN FOCUS

The Primary Mirror Fabrication Story



Above Des Lang describes the action of the Primary Mirror Cell

"All these clamps are on an eccentric rod. So, when you turn the rod, it brings the clamps either in or out. This will allow us to lock the side clamps onto the mirror to make sure the mirror does not move."

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GOING BIG

NEW LARGE SIZE PRINTING CAPABILITIES


Jason Gui


Declination axis Clamp handle
PAMFC transfer shaft upper bracket

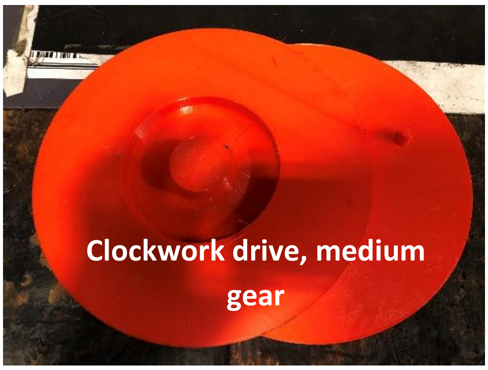

Ross Bencina


Creality CR10-S5 3D printer


Declination axis Clamp Handle

"Our new Creality CR10-S5 3D printer is enabling us to 3D print complex, large patterns for casting of replica parts."


Clockwork drive, large gear


Clockwork drive, medium gear


Declination axis movement coarse control drive gear


Jason Gui

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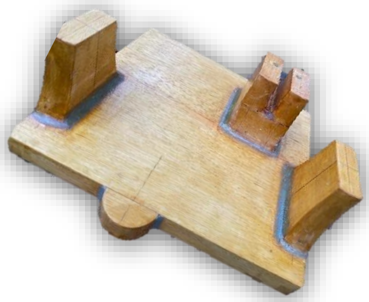
GLORIOUS PATTERNS

Pattern maker extraordinaire: A huge contribution to the restoration of the Great Melbourne Telescope, through the completion of dozens of high-quality patterns

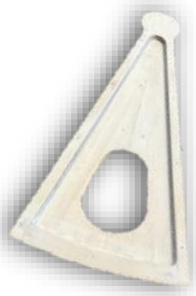


NOEL PAINE

"There was an email from ASV looking for help on the GMT restoration.

I have had experience so when they said they wanted castings, I put up my hand and said "I might be able to help with that"! I shuddered later when I remembered that it was over 40 years since I finished my short career in Sydney Road Brunswick as a patternmaker.

As there was nowhere to make patterns, I thought I could assist with my limited metal working skills, but I thought I could assist more if I could make patterns. I approached Woodcraft Manningham. Their focus is wood carving, wood turning and box making. I told them about the project, and they said I could come along and have a look at their premises. It is very well resourced with hand tools and machinery. Since then with the assistance fromr Simon and his team we have had great success."



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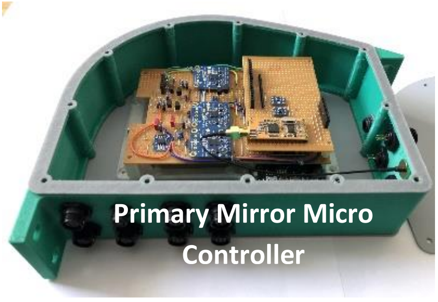
The Mighty Smalls Behind Reactivation of the Large


Bryan Mooney


Primary Mirror Micro Controller


Steve Bentley

" Progress on the GMT electronics continues at a steady pace. All the required components are now available to complete the assembly of the various boxes.
The enclosures are now painted and labelling has been applied to clearly identify each item and each socket.
Mounting brackets to fix the secondary mirror cell items to the mirror cell frame are now complete.

The primary mirror cell utilises a custom 3D printed enclosure frame which was a tough item to fabricate and required 3 attempts and a change to a better 3D printer before Bryan Mooney obtained success with this complex part.
The power distribution panel for the primary mirror cell is now fabricated and in the process of being painted.
The steel plate was cut to shape by Des Lang and the workshop volunteers also welded the fixing lugs and drilled and tapped threaded holes into the primary mirror cell frame to mount the panel.
This item contained numerous holes many of which have a tapped thread, all done by hand".

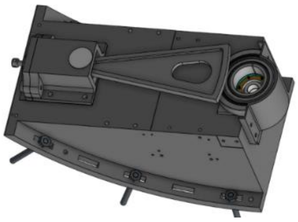
Steve Bentley

Secondary Mirror Controller (SMC) Microcontroller and Motor Drivers

Primary Mirror Controller Power Distribution

HOW MUCH BEARING CAN THE NORTH BEARING BARE?

North Bearing



Bearing System (3D Drawing)

North Support Quadrant

North Support Quadrant

"The awesome 9 tonne weight of the Great Melbourne Telescope is supported by two main bearings along the polar axis of the telescope. The upper bearing is located near the south end and the lower, shown in the photos, is found above the north pier. This bearing was originally mounted in conjunction with a bespoke load relief system specifically designed to remove some of the force acting on the bearing and allow it to operate as intended. While the system has now been made obsolete with modern advancements into bearing technology, it may ultimately aid in smoothing the rolling motion of the axle."

Sara Maric

New North Bearing with Adapter, Sleave & Nut

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Polar Axis Movement Fine Control

Mal Poulton

It has been quite a challenge to re-engineer this control system to match the image taken in 1867 in Grubb's Dublin workshop. We had the upper and lower cross braces, centre cross piece frame and the parallel motion mechanism. Bevel gears, hand control shaft and transfer shaft had been discarded by Stromlo with fine control of the Stromlo telescopes using a servo motor on the end of the threaded worm shaft.

We do have the worm shaft drive running through the parallel motion mechanism but are unsure if it is the original Grubb shaft modified by Stromlo or a new one made by Stromlo.

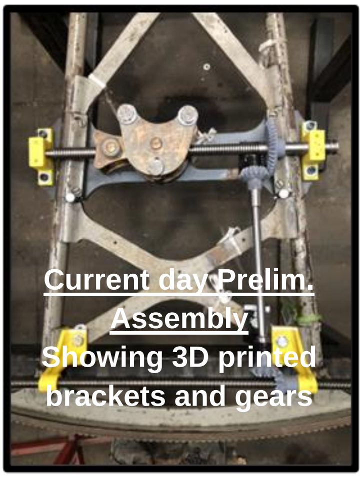
We made the decision to use this wormshaft and have made an extension piece for the west end and fabricated a cap for the east end to restore it as best we can to look like the original.

We were able to get reasonably accurate overall dimensions of most gears and shafts by comparing the scaled dimensions in the Dublin photo with known dimensions such as the lower crossbrace centre width and height but the tooth count not as easily established.

Original 1867 Dublin Works Photo Known dimensions were used to establish the size of the new components.

A number of studies of tooth profiles and overall ratios has been done to finalise the gear design and we have 3D printed the gears for preliminary assembly and checking. Gears are currently out for tender with options of cast teeth or machined teeth yet to be finalised.

Bracket dimensions were also scaled from the Dublin photos and designed to match the existing mounting holes in the lower cross brace and the centre cross piece frame. Brackets were first drawn in 2D using a CAD package then the design transferred to a 3D modelling program. Fine tuning of angles and dimensions in the 3D model then gave us the opportunity to print out the brackets in a 3D printer. The printed brackets were then used with preliminary machined shafts and the 3D printed gears give us an overall assembly for checking.



Current day Prelim. Assembly
Showing 3D printed brackets and gears

Preliminary checking has proved helpful and we are now in the process of final machining of shafts, brackets and shortly, gears, and then doing a final assembly of the Polar Axis Movement Fine Control.

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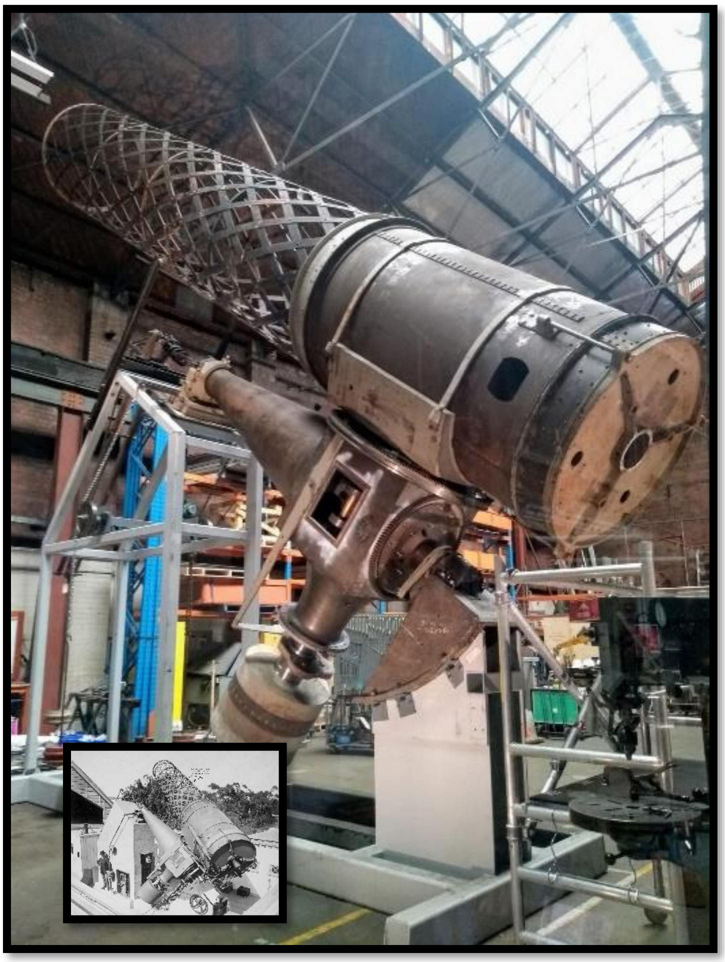
Great Melbourne Telescope Maintenance Manual October '22

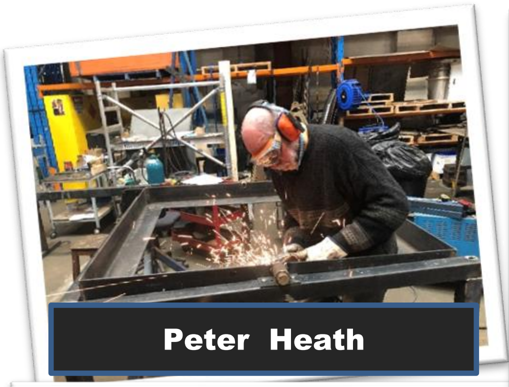


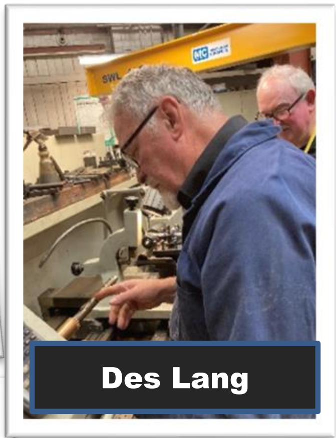
As It Stands Today:

In its current condition, the Great Melbourne Telescope has had two distinct and separate (by time and distance) groups of people working on it. Initially it was designed, fabricated, and assembled (1860s in Dublin and Melbourne) by Thomas Grubb and his people. Designed at the limits and beyond, for its time. It would be interesting to know just what "life" Thomas thought the telescope would have. The second group is the team from both Museums Victoria and a diverse range of volunteers with the task of restoring the telescope as accurately and sympathetically as possible so that it can again study the night skies from Melbourne. Again, it's interesting to contemplate the next "life" of the telescope. How long will it be valued as an important part of the history of astronomy in Australia. Plus, as an object from the history of Victoria. The Maintenance Manual is an important step in ensuring the preservation of the Great Melbourne Telescope. It will take the current knowledge gained from a truly talented team of volunteers and assemble it in logical and easy to follow fashion. So, the legacy of the current project will not only be the Great Melbourne Telescope in working condition but also all the information necessary to maintain it into the future. We have less than four years to build the document.

Ian Marshall

WHO'S OLD & NEW IN THE WORKSHOP ZOO?

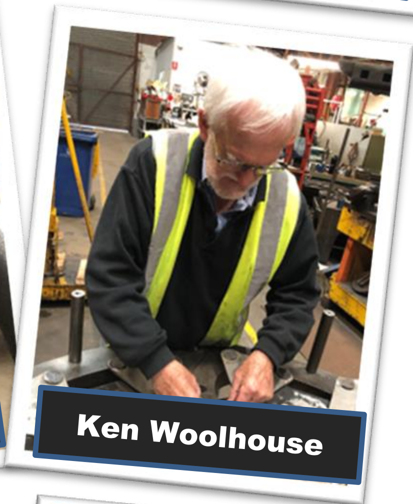

Peter Heath


Des Lang

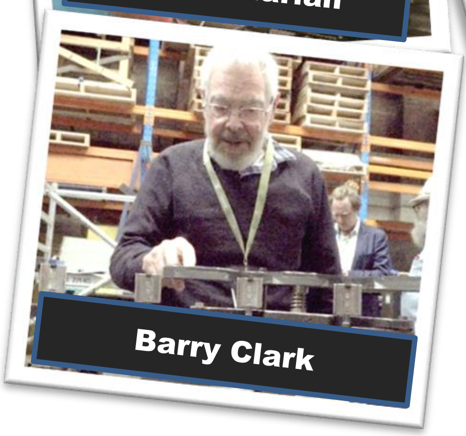

Eric McCallum


Ross Bencina


Jason Gui


Ken Woolhouse


Frank Marian


Barry Clark


Laurie Goodson


Mal Poulton

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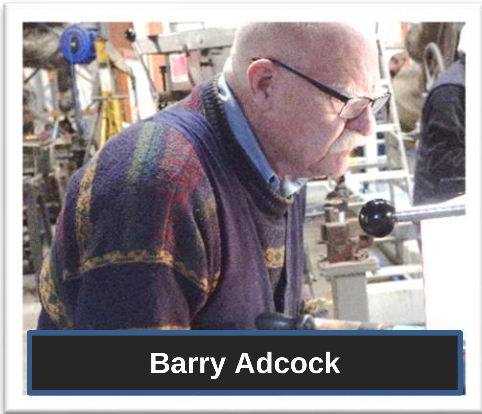
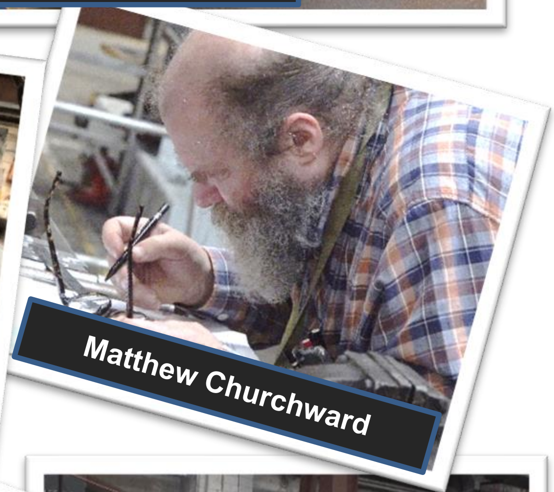
WHO'S OLD & NEW IN THE WORKSHOP ZOO? PART TWO


Barry Adcock


Raveesha Mesthrige


Tom Miller


Eric McCallum


Matthew Churchward


The Machining Team
Bob, Frank & Jason


Allan Watson


Bob Crosthwaite

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WHO'S OLD & NEW IN THE WORKSHOP ZOO? PART THREE

Laurie is milling the Declination axis movement course control (slewing) Handwheel Shaft as Tom watches on.

Peter finishing off the Polar Axis Movement Course Control (Slewing) small bevel gear

Mal with his favorite piece, "Polar Axis Fine Control"

Bob finishing off the Baffle Support Frame

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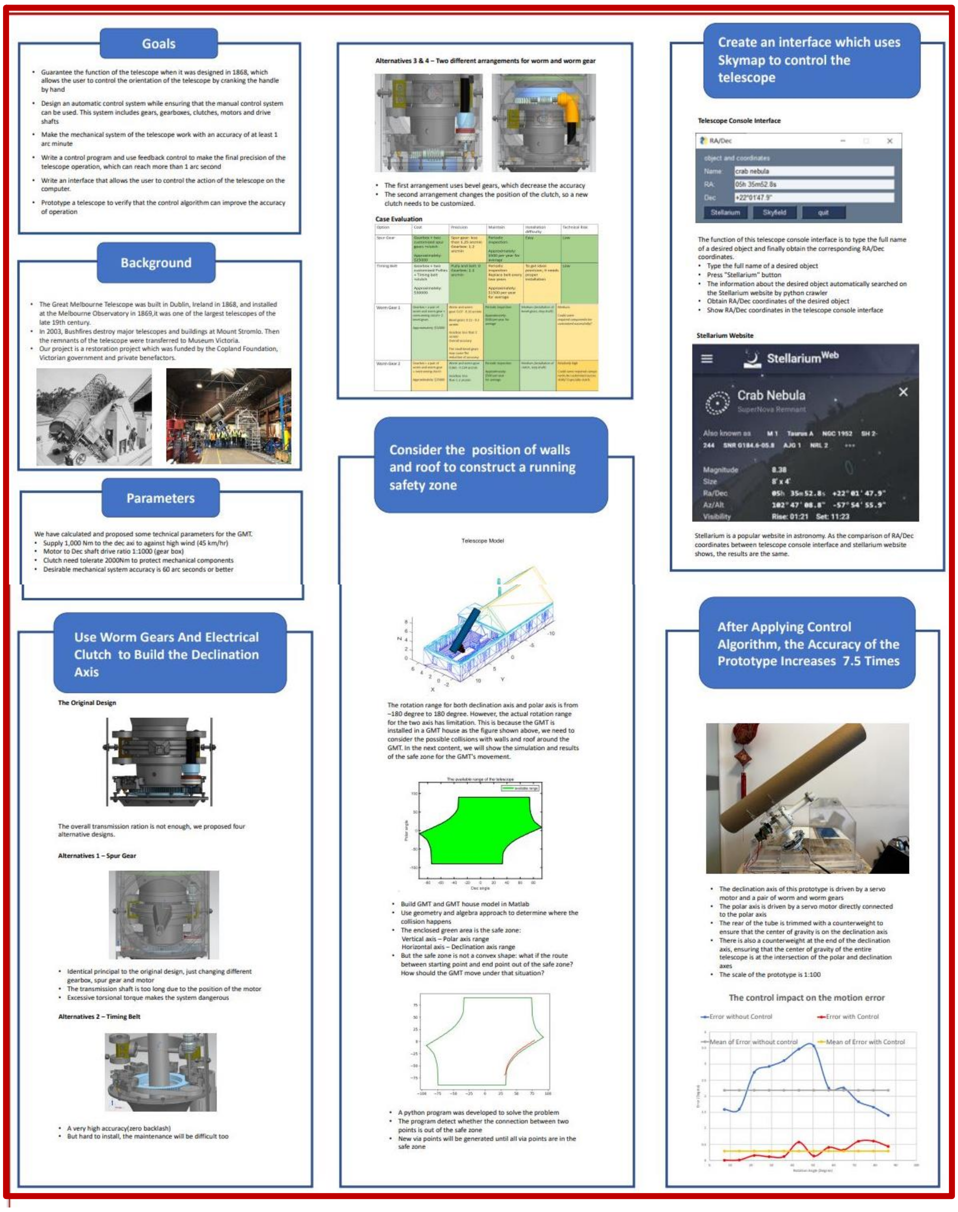
GMT IN MOTION

–THE UNIVERSITY OF MELBOURNE CAPSTON GROUP:

Motor Control Systems for the G.M.T.



The Melbourne University GMT Motor Control Capstone Group of Geng Chen, Guanxu Pan, Nan Zhao and Zijian Chen, (Supervised by Prof. Jonathon Manton. School of Mechanical and Electrical Engineering - The University of Melbourne), embarked on an epic exploration of control system designs for an electromechanically activated "Great Melbourne Telescope". The project involved further development of declination axis motor drive system concept designs, development of a feedback control system for both axes, construction of working prototype (complete with encoders, motors and clutches), movement limitation constrain assessment and user console interface development. While electromechanical activation is beyond the scope of the four year completion plan, the project is still aiming to ensure that the restoration allows for later integration of these systems. The project was completed with a high level of competency and will be a great reference for ongoing design work. Congratulations to Motor Control Capstone Group on a project very well completed.

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A WORD FROM THE PROJECT MANAGER

This year, being “2022” was, by definition, a year of many twos with only the occasional zero. So too on the Great Melbourne Telescope Restoration Project. The two Barrys continued to provide fantastic overall leadership and guidance for the project. Bryan and Steve B teamed up to make great progress on the two microcontrollers, with software development assistance on the two codes from Ahmed, Phillip and Ross. Work on the two mirror cells progressed nicely, with great hands-on fabrication contributions from Ahmed, Alan W, Barry A, Des, Jason, Ken, Laurie, Tom and others. Peter single-handedly built test frames for the two mirror cells, while Bob worked his magic on the baffle support frame. Douglas, Horatio and Raveesha all assisted with completing the optical tube counterweights, although they appeared to miss the memo and gave us three compartments instead of two!!! Sara did a fantastic job progressing designs for the two axes encoders. The mechanical control systems for the two axes continued to take shape in the hands of Eric, Frank, Laurie, Peter, and Ross, realising the vision of the dynamic design duo, Allan D and Mal. Matthew found us a couple of super high-resolution scans of historical GMT images, that have been highly valuable for design progress (OK it was four). Two new experienced engineering team members, Ian and John, started to make great contributions in the areas of maintenance coordination and gear procurement respectively. There were two Capstone project groups, working at the forefront of design development. Noel just made TOO many fantastic patterns to count, while Jason, Manashaa and Sara assisted with 3D printed gears and patterns.

So what were the zeros? Well, we made a lot of round things: counterweight tubes fabricated, the secondary mirror support cylinder built, dummy mirror completed, gears turned, patterns 3D printed, bushings machined, baffle support centre fabricated and lots of holes drilled. The award for the biggest zero for the year does of course go our primary mirror, which has continued to be delayed. On that we can only hope for some better progress in 2023!!!

Overall, 2022 was a highly successful and enjoyable GMT restoration year, with great contributions by so many.

SIMON BRINK