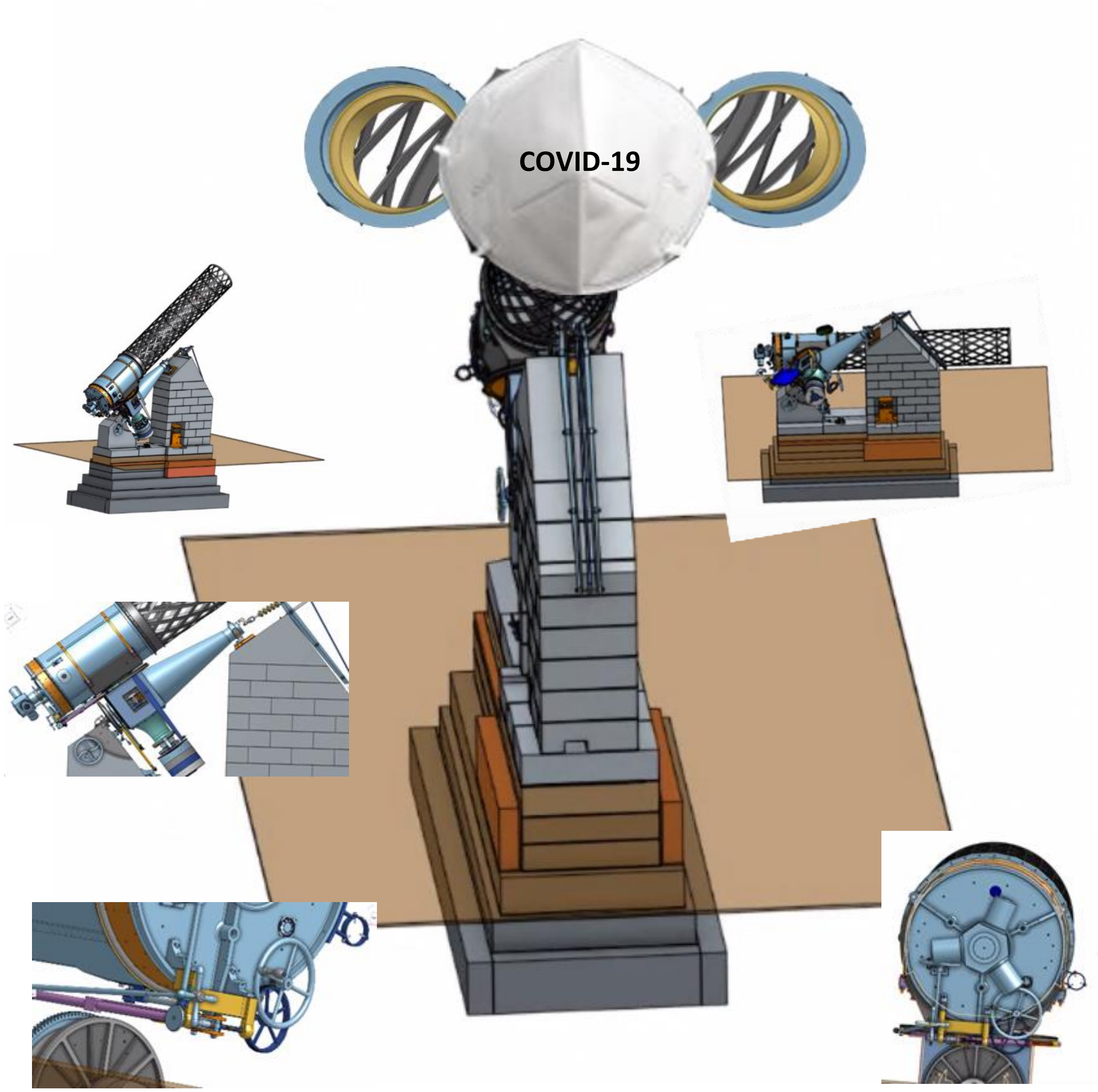
November 2020
Editor: Bob Crosthwaite

The Great Melbourne TELESCOPE

Phoenix

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

OUT OF THE FIRE AND INTO THE PANDEMIC:



After the fantastic effort of the restoration team, in bringing new life to the Great Melbourne Telescope, for its 150th anniversary celebration in 2019, along came the COVID-19 pandemic. All structural work ceased at Scienceworks, but behind the scenes, many of the team members still contributed (virtually) by designing a variety of the missing and new parts see page 4 for the various group's membership. Due to their efforts, we are now in a better position to continue the work, on the next stage of the Great Melbourne Telescope restoration.

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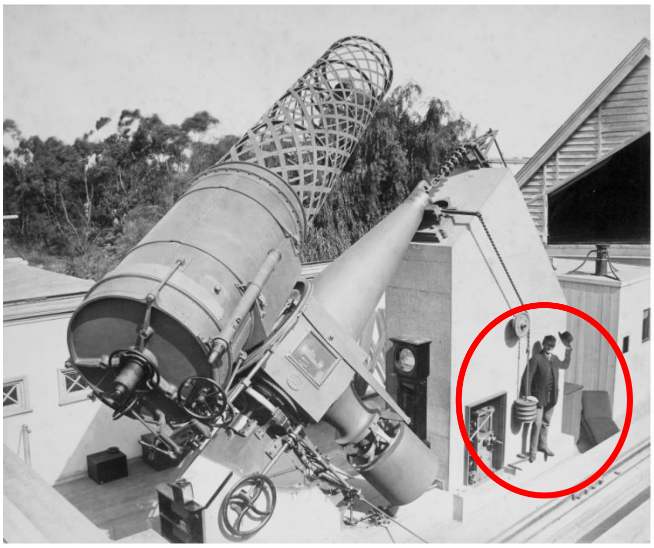
JOSEPH TURNER: TAKES HIS HAT OFF TO ALL THE HARD-WORKING VOLUNTEERS WHO GAVE LIFE BACK TO THE GREAT MELBOURNE TELESCOPE.

1872 Robert Ellery, who was the Government Astronomer and President of The Royal Society of Victoria was required to fill the role of observer after the resignation of Farie MacGeorge. Joseph Turner, born in South West Scotland and in 1872 he was a resident of Geelong, Victoria. He was short-listed to fill the role of observer and after some debate he secured the position.



Over 11 years Turner worked closely with Ellery observing and sketching Eta Carinae, The Carina Nebula and many of Herchel's objects some without success.

In 1874 Ellery and Turner focused their attention on the Transit of Venus, but technical difficulties ruined their observations.

Before becoming the observer, Joseph Turner owned a successful photographic studio in Geelong and he brought these skills to his attempts to take photographs of nebulae with the GMT.

In 1883 Turner and his son obtained photos of the Orion Nebula with a exposure of only 4 mins. testifying to the light gathering capability of the GMT. This was the first photograph of a nebula taken with a telescope in the Southern Hemisphere.

Back at his photographic studio in Geelong, his skills in photographic developing and enlarging techniques won him world-wide fame for his photos of the Moon.

In 1883 Joseph Turner Died of Pneumonia.

For a more detailed account refer to Richard Gillespie's publication The Great Melbourne Telescope.

Bob C.

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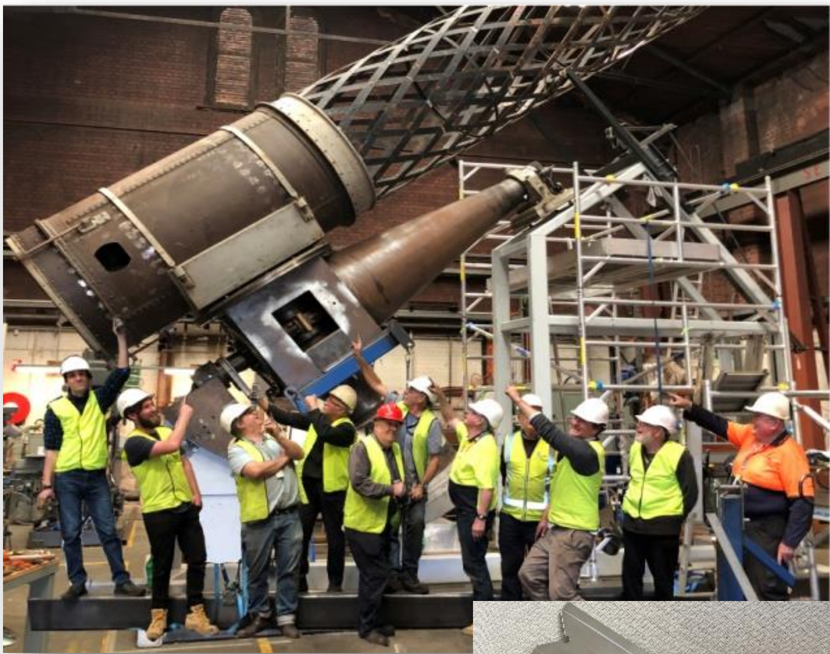
GMT Angle of Elevation   Steve Roberts

(After 10 years of work) We assembled the Great Melbourne Telescope and mounted it on the blue steel frame designed by BECA Engineering and manufactured by Third Angle.



Here it is, indoors at Scienceworks. We can't turn it yet, as it would hit the beams in the roof.

The latitude of Melbourne - specifically of the telescope's final location at the GMT house - is 37.83°S, and this is the angle that the telescope's polar axis should be aligned. We measured the angle roughly at 37°; the quadrant at the north bearing end is bolted to the north pier through slots and could slide up and down a little bit. I bought a digital protractor, with a spirit level in one arm, and we measured 37.41° with that. Actually, it was quite hard to find a flat surface on the GMT upon which the instrument could be placed.

To correct the elevation angle by that 0.42°, we could simply lift up one end of the mounting frame itself, but that's a silly idea because it would not apply when the GMT is mounted in the GMT house. The southern bearing assembly, at the top end of the south pier, has historically been mounted on a shim plate upon a platform on top of the pier, and we could vary the thickness of those. We'd need to thicken them (raising the southern bearing) by several centimetres, and then possibly adjust the quadrant at the north end, to make the north bearing sit at exactly 90° to the polar axis; that would be done by moving the quadrant slightly up or down in the mounting slots, which would require the thickness of the southern shim plate to be re-adjusted in turn.

We'll have to keep that solution in mind (or find a better one) ready for that glorious day when the GMT is mounted on its piers, yet to be constructed, in the GMT house. Of course, at that stage we'll be able to verify the telescope's angle of elevation astronomically, by looking through it at σ Octantis,*   wah-hey.

Meanwhile, COVID-19 restrictions have imprisoned my digital protractor at Spotswood, so now I can't use it for home woodwork projects. I bought another one, delivered to my house.

=== footnote ===

*The dimmest star to be represented on any national flag! The flag of Brazil depicts the sky, seen from infinity back towards Rio de Janeiro, at 11:37 UT on 1889 November 15; each star is assigned to one of the provinces of Brazil, and the *dimmest* star sigma Octantis represents the Brazilian Federal District.

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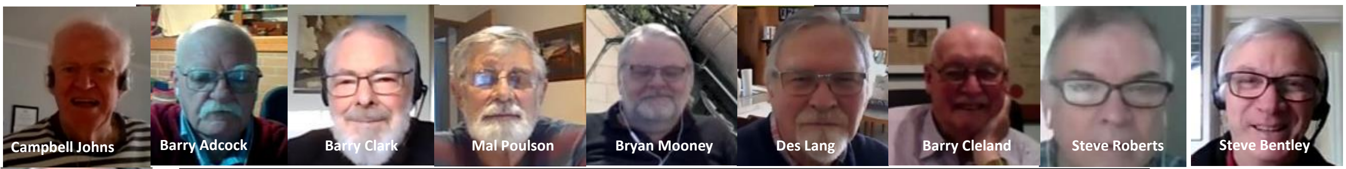
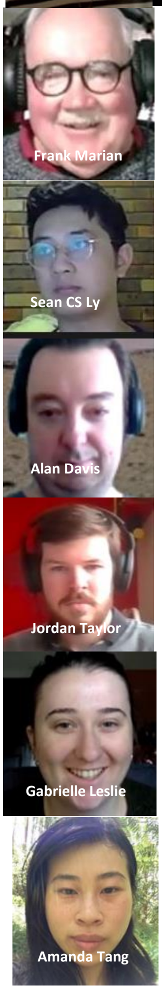
WORKING IN THE BACKGROUND

The award of the contract for the primary and secondary mirrors in early 2020 was certainly a huge step forward for the project, but did mean that further available uncommitted funds were quite limited. As such, a significant focus for 2020 was always going to be a completion of remaining aspects of the design. This strategy was helped significantly by the onset of COVID-19. With the design team largely confined to home activities, there were no excuses available for not progressing with important design work!!! Thanks COVID-19.!!! One team member did of course manage to sneak across the Victorian border in an attempt to escape his project commitments, but was eventually tracked down from his glorious photos of outback NSW sunsets and lured backdown south. Design activities in 2020 were focused around eight weekly chat groups, with significant and valuable contributions being made by the design team of around 15 volunteers, more than 10 student interns and Museum Victoria staff. The teams and their members are shown below: Simon Brink





Clockwork, Sidereal/Lunar and Link Drive:
Frank Marian, Jess Widjaja, Alan Davis, Des Lang, Barry Clark, Bryan Mooney, Ujashkumar Patel, Amanda Tang, Ken Woolhouse, Matthew Churchward.

Polar and Dec Axis- Coarse and Fine Control:
Ken Woolhouse, Jess WidJaja, Allan Davis, Des Lang, Mal Poulton, Bryan Mooney, Matthew Churchward.

Turret and Digital Optics:
Barry Adcock, Bryan Mooney, Steve Bentley, Jerimiah Flasza, Gabrielle Leslie, Melvin Lee, Andrew Angkadjaja, Des Lang.

Electro-Mechanical and North Hub:
Steve Bentley, Mal Poulton, Louis Hosni, Sean Cs Ly, Barry Clark, Jessica Widjaja, Wei Zheng Ong, Jordan Taylor, Jerimiah Flasza.

GMT Primary Mirror Cell Design:
Barry Adcock, Barry Clark, Bryan Mooney, Steve Bentley, Dexion Lim, Des Lang, Dishan Anand, Gabrielle Leslie, Matthew Churchward.

GMT Secondary Mirror Design:
Barry Adcock, Barry Clark, Matthew Churchward, Bryan Mooney, Wei Zheng Ong, Jordan Taylor, Jessica Widjaja, Steve Bentley, Des Lang, Jerimiah Flasza.

GMT 3D Design Coordination and Intern Weekly Grp. Catch-up:
Jessica Widjaja, Allan Davis, Andrew Angkadjaja, Louis Hosni, Amanda Tang, Jordan Taylor, Gabrial leslie.

Structual:
Campbell Johns, Bryan Mooney, Barry Adcock, Matthew Churchward, Des Lang, Steve Roberts, Ken Woolhouse, Barry Cleland.

Dexion Lim | Melvin Lee | Andrew Angkadjaja | Dishan Anandan | Ujashkumar Patel

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On Sunday 24th. November last year, over one hundred keen participants attended Scienceworks Pumping Station, north boiler room, to celebrate the 150th. anniversary of the Great Melbourne Telescope

The colourful history of GMT was described to the enthusiastic attendees by four experts, Prof. Fred Watson AO, Mr. Matthew Churchward, Dr. Richard Gillespie and Mr. Barry Adcock. After the formalities the audience viewed the magnificent structural restoration of the astronomically significant icon, The Great Melbourne Telescope, in its original form, for the first time since 1945.

Photos by Stewart Donn HR MuseumVic
150th.Anniversary GreatMelbourneTelescope

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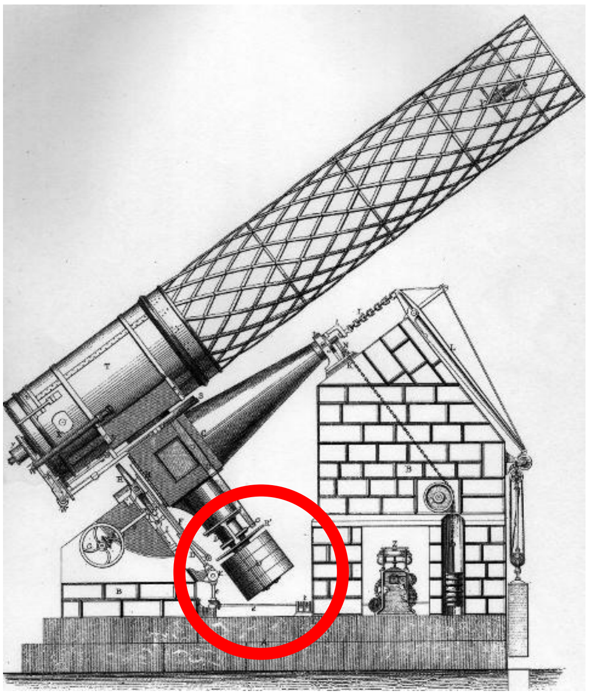
GMT Counterweight News   Steve Roberts

The GMT has four rings of weights at the lower end of the declination axis, balancing the weight of the optical tube about the polar axis. Each of these counterweight rings has six internal compartments, which historically would have held lumps of lead (Pb) that are now long gone.

In the original telescope, the optical tube itself was also accurately balanced around the dec.axis, the 1000-kg speculum-metal mirror at one end countering the moments of the longer 550-kg lattice tube and secondary mirror at the other end. And here comes one of our Big Problems: arising from our decision to install a much lighter Pyrex primary mirror. We prepared a spreadsheet listing all the components of the optical tube and dec.axis, existing and proposed, with their masses and spatial locations. Adding up the moments exerted by all these components under gravity, we estimate that 650 kg of ballast will be required behind the new mirror.



The calculation was complex - it took four people two months, on and off, so we will keep re-checking it as we proceed, collecting all possible new data. But now we are thinking about how we might achieve 760 kg of ballast, without having things sticking out from behind the mirror and ruining the historical appearance of the telescope.

Then, supposing that we do achieve that 760 kg; the spreadsheet shows that we will then need to place 1,675 kg of mass into the counterweight rings, to balance the entire optical tube assembly (with the 500 kg weight of the rings themselves, plus the declination axle and its furniture; and allowing for the different positions of the rings along the dec.axis.) There are four rings, each having six compartments, but three in the lowest ring are taken up by external weights, that can be physically butchered and adjusted while the telescope is fully assembled and working. So, we have 21 compartments available to us.

We commissioned shapes cut (by laser) from inch-thick steel to fit into them. Each shape weighs about 6.4 kg and there are six to each compartment, thus about 800 kg of mass; and we need 1,470 kg.

We are therefore seriously considering going back lead (Pb) for the counterweights, Relative densities (water = 1) of Pb = 11.35 and steel = 7.85. we also considered, less seriously, using tungsten (19.6), gold (19.3) or depleted uranium (19.1) - each of which would confer its own peculiar and much worse problems.

The volume of each compartment of the counterweight rings is about 7 litres, and we need 80 kg of weight in each one. The steel shapes give us 38 kg, with some air space. Lead shot would fill all the space and would be easy to handle, however (as the people who make egg cartons and fruit boxes will tell you) the best close-packing of spheres fills only about 70% of the space. If we used solid lead, by pouring molten lead to completely fill the compartments (here's a pause while readers come down from the ceiling:) would give us only about 72 kg. Therefore, we are looking at adding internal weights inside the axle and heavy plates on the top or bottom to make up the deficit, and looking for a way to avoid using lead altogether. Anguish is continuing.

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MIRROR - MIRROR … WHO IS THE FAIREST OF THEM ALL? … THE GMT 48 INCH!


Certificate of Ownership

This is to certify that

Museums Victoria

Is the legal owner of

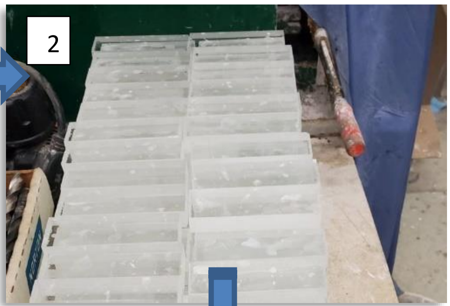
The 48 inch GMT Mirror Blank

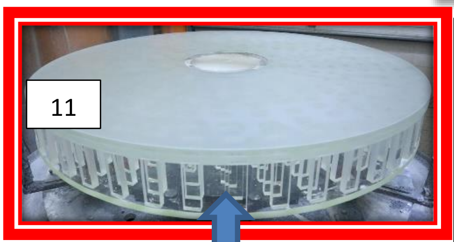
On this 10th Day of OCTOBER In the Year 2020

At: #6, 1111 Harwood Street, Vaudreuil-Dorion, Québec, Canada (J7V 8P2).

Signed,

FBLOS





The contract to manufacture the GMT Primary Mirror was placed with Fullum Brunet Large Optical Systems Inc. (FBLOS) of Quebec, Canada at a cost of USD$240k. and it is expected to be delivered to OZ in late 2021

The mirror is being formed out of Borosilicate.

PHOTOS:

1. Top plate assembled before fusion. Two 16mm plates were fused together to form the top plate

2. Pillars to be used to fuse together the top and bottom plates.

3. Pillar pattern assembly is placed into position prior to fusing.

4. Fused top and bottom plates with pillars.

5. 6. 7. 8. 9. After annealing the mirror is carefully lifted and placed safely ready for the inspection and polishing.

10. Grit 120 Surface Achieved.

11. Just cleaned and being prepared to be polished with Opaline. All's good, uniform granularity with no apparent "black pits".