

# **The Leviathan of Birr Castle**

## **A model by Rob & Sue Dipple**

Whilst preparing the talk about our trip to Birr Castle in Ireland it was suggested that a 12<sup>th</sup> scale model should be made to go along with Sue's other hobby of 12<sup>th</sup> scale dolls houses.

A reasonable idea except for the scale, the footprint of the walls is approximately 22 x 12 meters. A 12<sup>th</sup> scale model would therefore be 1.83m x 1m plus surroundings so heading towards 2x1.5m. Nice idea but way too big. So we went for another common size of 48<sup>th</sup> scale with a finished size of 0.5 x 0.25m plus surroundings.

The build method of choice was to 3d print as much as possible. Two problems here. First my 3d printer has a maximum print size of 150x150x150mm so the walls and base would be too big to print. Secondly the smaller items such as the rails of the gantries are very small, perhaps 75mm square section so at a 48<sup>th</sup> just over 1mm printed.

The latter was resolved by designing oversized parts, within reason, so use 2mm instead of 1mm section etc.

The former was achieved by designing to scale and then splitting the large parts to fit the printer. Location pegs were then included to aid assembly.

On completing the design we realised that 1/48<sup>th</sup> scale was still too big so each part was printed at 75% of design size giving a final size of 1/67<sup>th</sup> scale.

### **The Design**

Creation of a 3d printed item requires two basic stages. First create a drawing of the item, then create a file that can be sent to the printer. The printer has its own software that can convert standard format files into the required commands for the printer.

A 3d design package is therefore required. Many are available, some free, some expensive, some web based. Needless to say they will all produce the required files for the printer software.

I opted for the free version of Fusion 360 - see <https://www.autodesk.co.uk/products/fusion-360/>. The free version has some limitations and requires that the licence is renewed every year.

This package is not the easiest to get to grips with but is very comprehensive allowing for the design of individual parts that can then be imported into a final assembly.

For convenience I split the project into several parts.

1. The base or ground works.
2. The Walls.
3. The Tube.
4. The Front Risers.
5. The Ramps or upper galleries.
6. Tube lifting.

The model is a reasonable representation of the Leviathan but some of the dimensions are an educated guess.

Information was acquired from web pages and three books:-

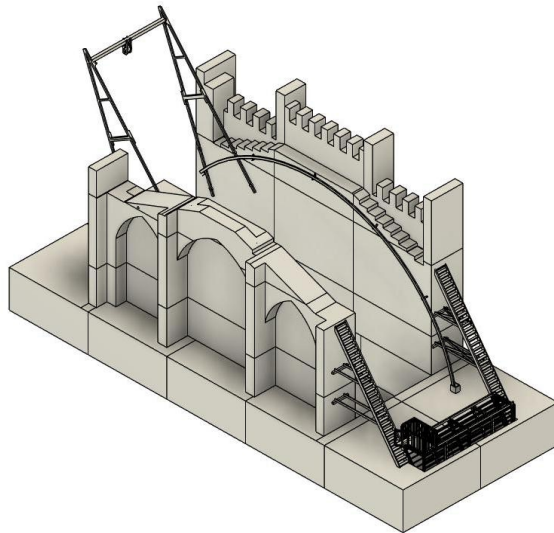
- William Parsons 3<sup>rd</sup> Earl of Rosse edited by Charles Mollan.
- The Monster Telescopes, Erected By The Earl Of Rosse, Parsons town by William Parsons.
- The Astronomy of Birr Castle by Patrick Moore.

The image below shows the bulk of the assembly. Missing are the galleries, tube and mount.

The walls are initially sketched as single units before being split into printable sized pieces.

The walls are each split into nine sections and the 'ground' into ten.

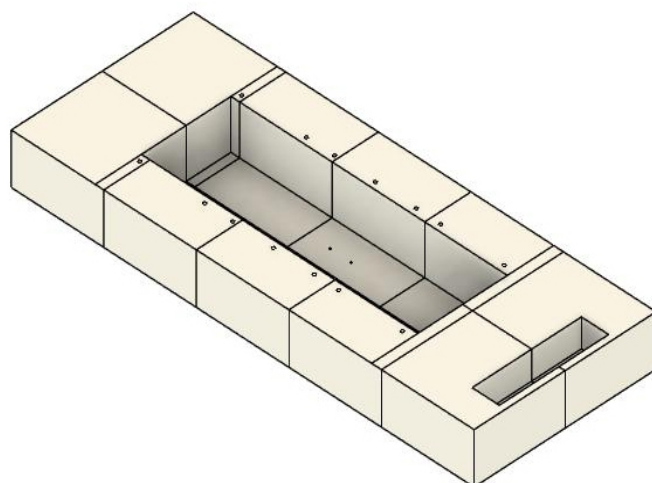
Originally I only wanted the walls and ground in this part but other parts had to be included in order to get the dimensions correct. This part therefore ended up included all except the tube and the upper galleries.



#### The ground assembly.

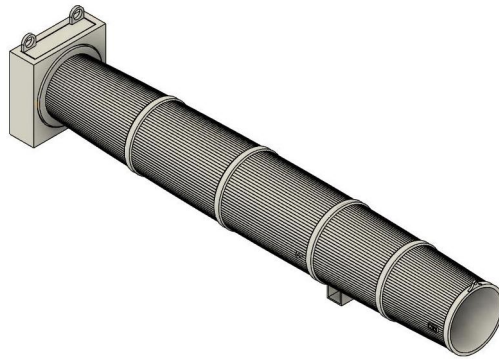
Made up of 10 blocks. The small holes on the upper face are for pins to locate the walls. Two others can also be seen in the bottom of the centre block used to locate the universal mount.

Each block is 55mm deep 110mm wide and 110 to 115 long.



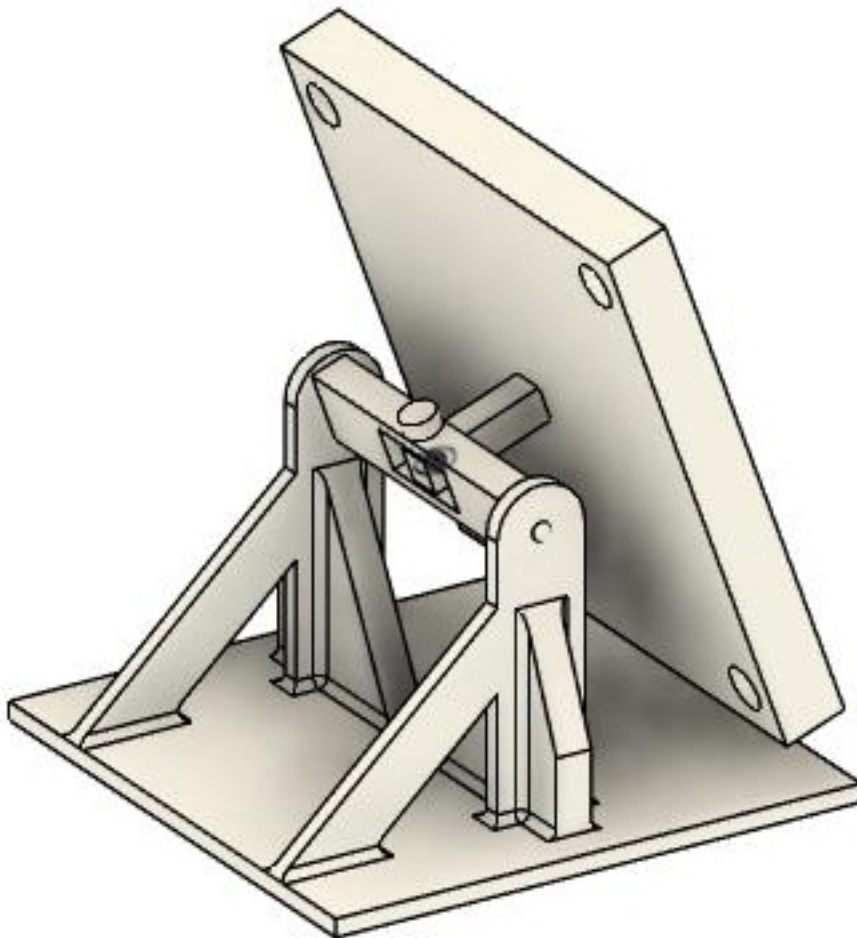
### The Tube

Constructed from 8 printed parts. 3 for the tube, an end box, a mirror box ( with the rings on top ) and three mounting parts. All are glued together except for the mirror box which can be removed. The total length is 275mm, the tube being 255mm.



### The Mount

Two basic parts. The base unit which is fixed to the 'ground' and the universal joint which is fixed to the 'tube end box' Not an exact copy of the original but a reasonable compromise.



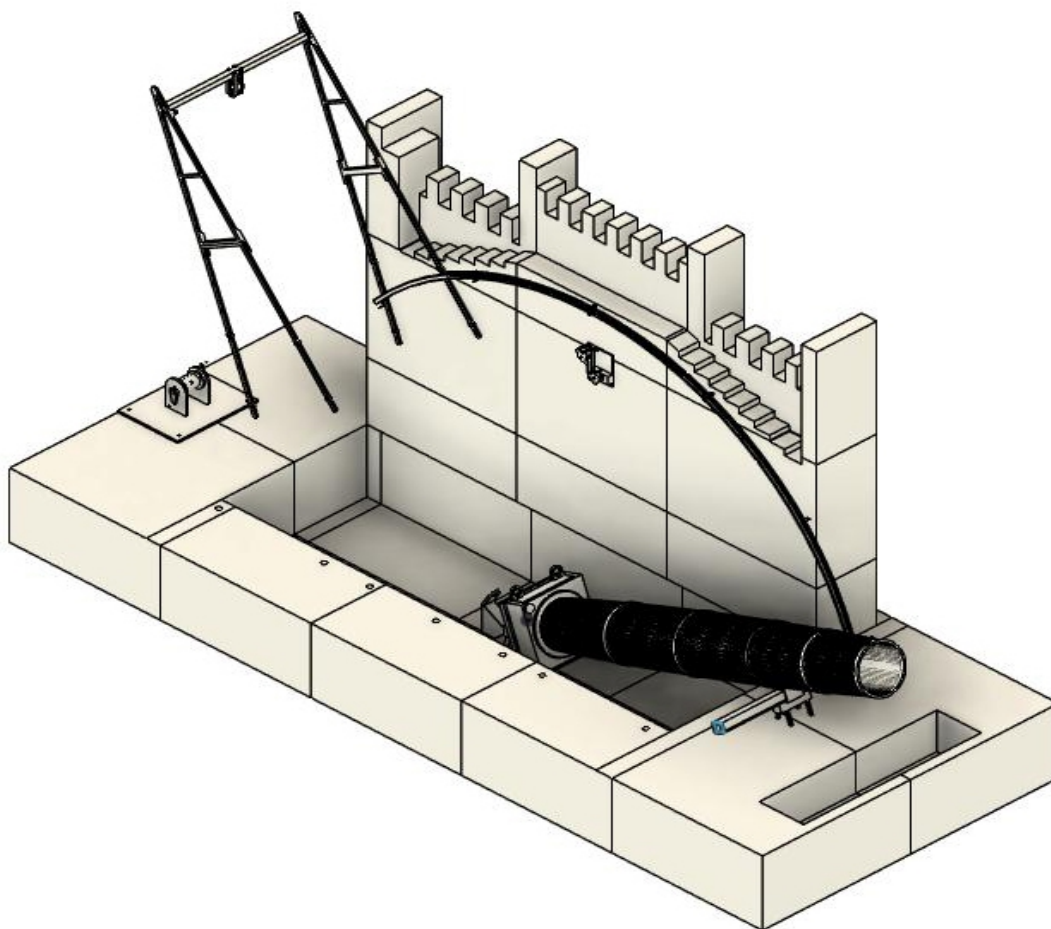
### The Walls

As can be seen from the first image above the walls are each split into 9 blocks. The lower two rows are much the same for both walls, however the top row is different since the left wall is lower to allow the mounting of the access galleries.

That covers the prime construction of the observatory and telescope. Leaving the user access galleries and the telescope adjustment system.

### Telescope Guiding.

This shows the basic parts of the telescope tube control mechanism.



Towards the front of the telescope tube is a rectangular steel tube at 90 deg to the tube axis. Through this runs a beam that is loosely attached to the arced rail on the right wall. When the front of the tube is raised then the beam follows the arc. Gearing within the steel box and rods up to the observer allow the observer to track a target in azimuth.

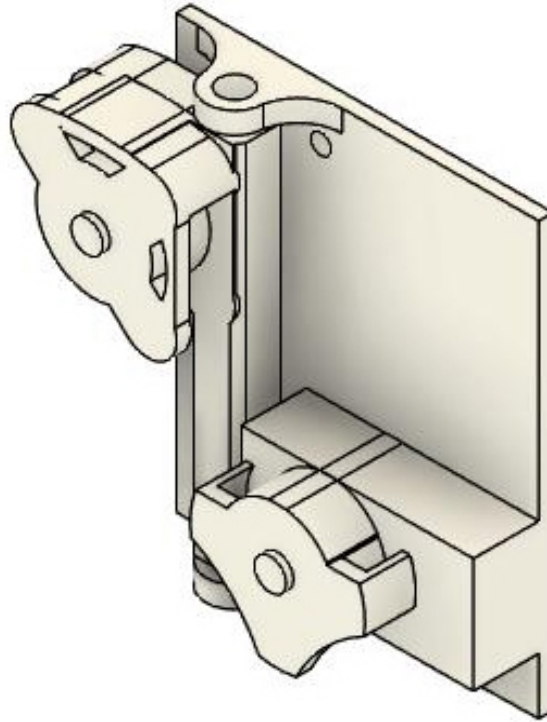
The 'A' frame timbers at the North end of the walls support a beam that carries a pulley. A cable runs from the winch on the ground, through the pulley to the front of the tube allowing for the raising and lowering of the telescope.



To assist the lifting of the tube a counterpoise system is incorporated.

It consists of two pulleys on a mount. The upper pulley will rotate 180deg whilst the lower is fixed .

A chain with a cast iron weight is attached to the 'A' frame. It goes under the lower pulley from the right, over the upper pulley then down to the side of the tube. In this view the A frame would be to the right of the lower pulley.

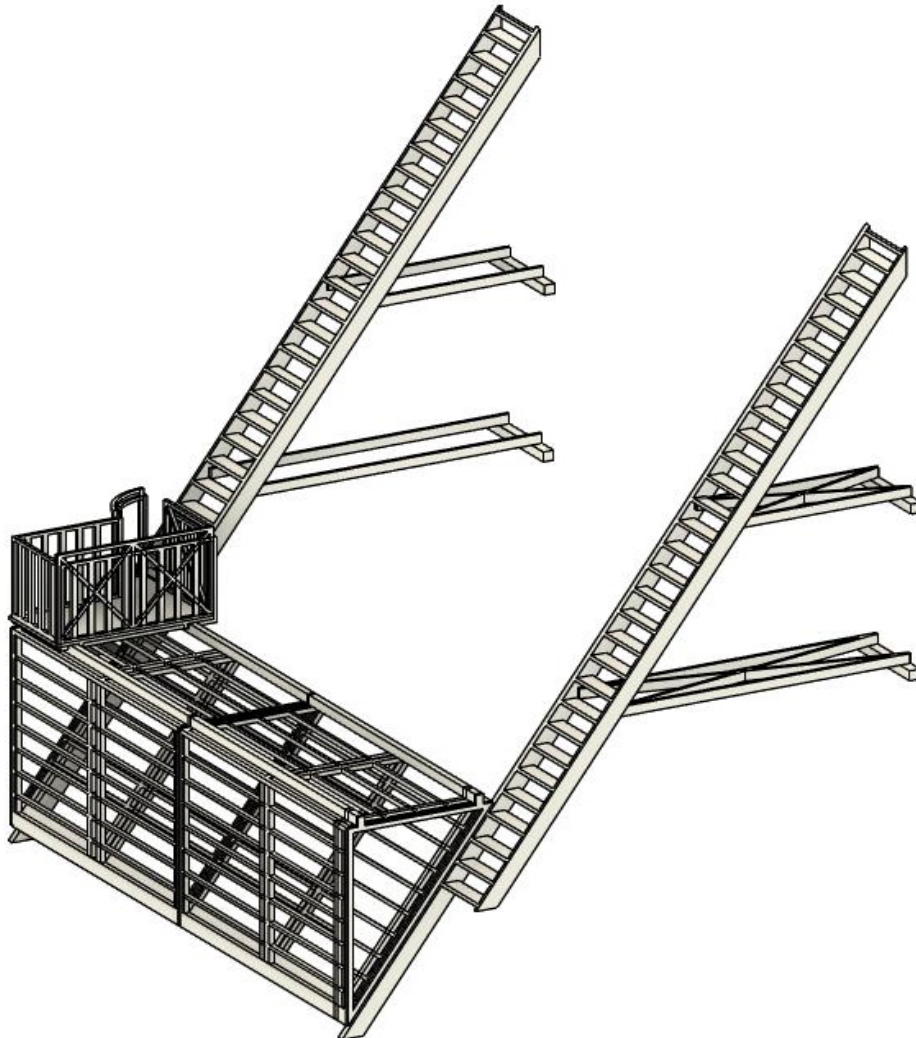


When not in use the front end of the tube rests on a stand.

Due to printing restrictions each 'A' frame was printed in two pieces and the guide arc in four pieces.

## Observer Access

### Low altitude targets.



Consists of 16 different parts that then assemble into 4 pieces:-

Left and right 'Steps' and support brackets.

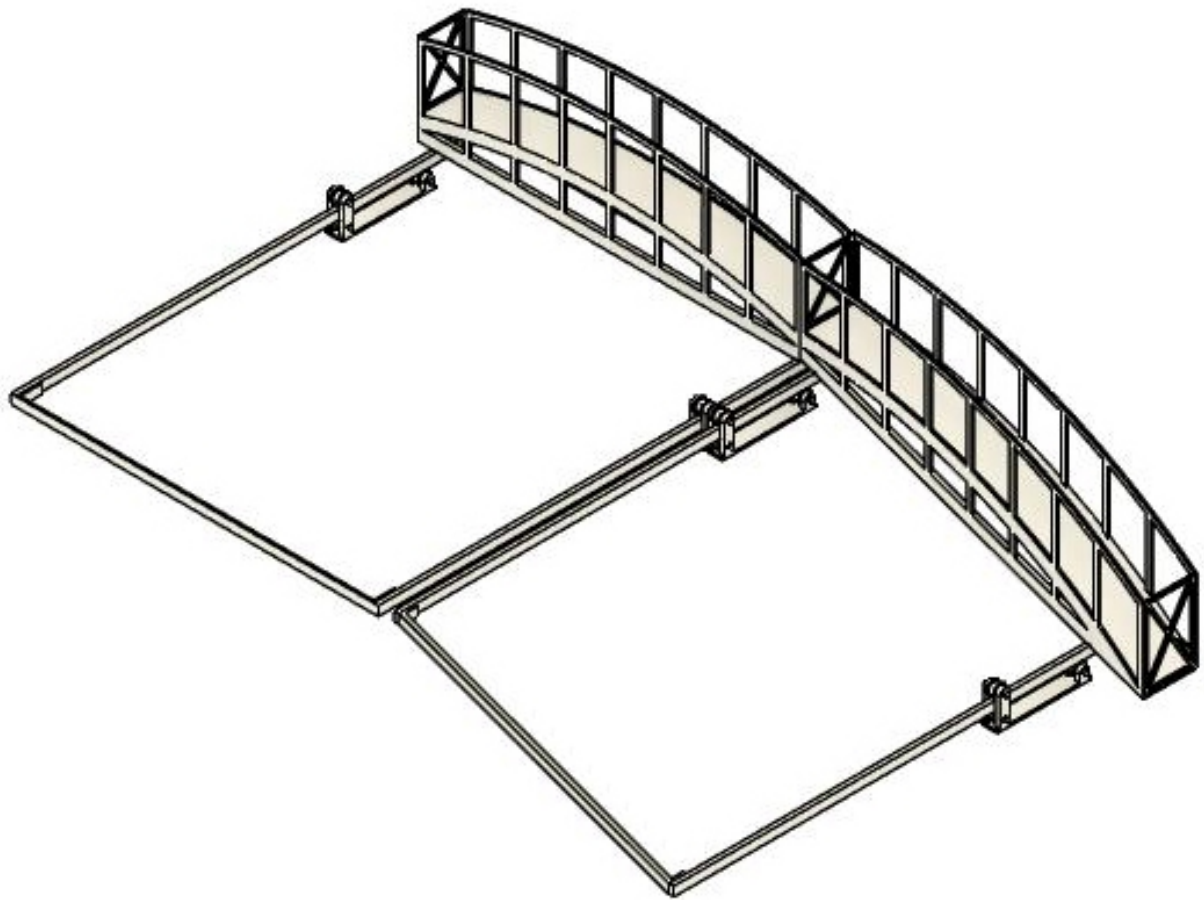
The front riser – the triangular section resting on the steps.

The front carrier.

The front riser is raised up and down the steps to follow the telescope in altitude. The front carrier is moved along the top of the riser to follow the telescope in azimuth.

The steps are stuck to the ground and walls. The carrier and riser can be manually moved.

## High Altitude targets



The upper ramps with their mounting blocks.

Each ramp consists of a 4 piece rectangular frame which sits on two of the mounts.

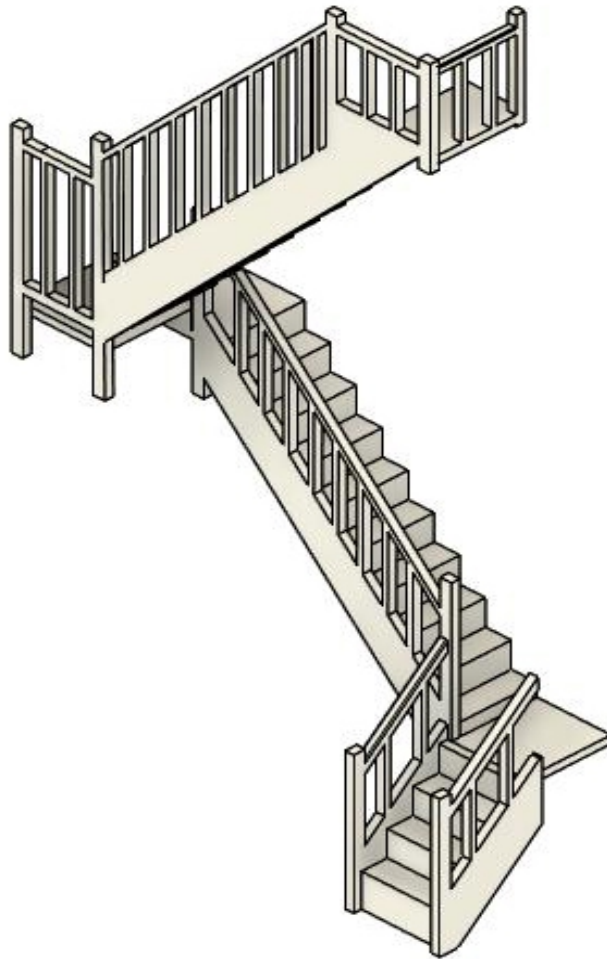
Each gallery is printed in two pieces, one is the frame facing the front plus the walkway and the second is the frame at the back.

Additionally separate end frames were printed.

The mounts are glued to the top of the left wall.

The mechanism for moving the galleries has not been replicated in this model, however things that should move do.

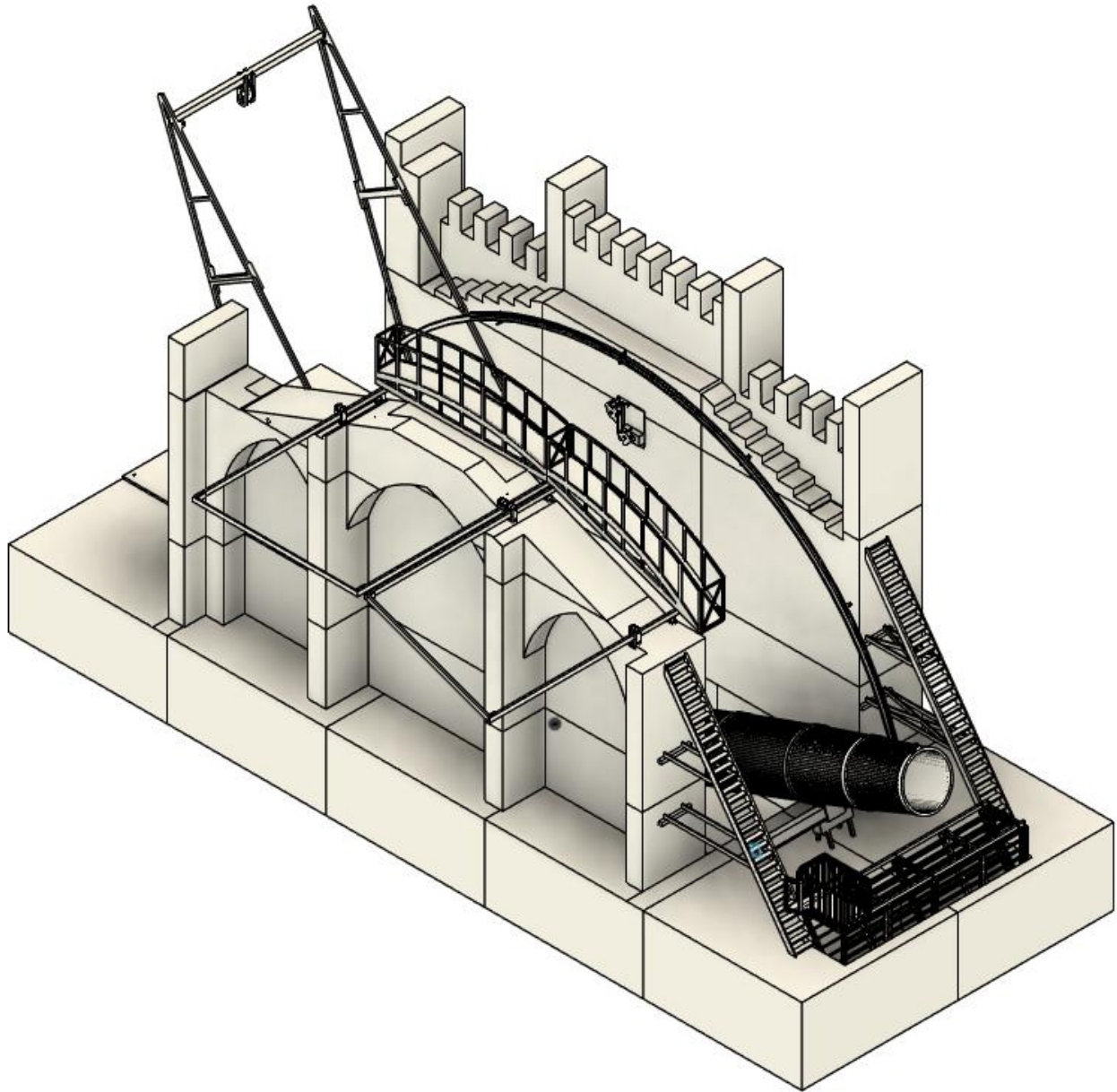
## Access Steps



These steps allow for the observer to access the upper galleries. They were a late addition to the model and were drawn at 1/67<sup>th</sup> scale and will therefore not fit into the other drawings which are at 1/48<sup>th</sup> scale.

Printed in four pieces- upper, middle and lower stairs plus the lower side panel.

## The Complete Design.



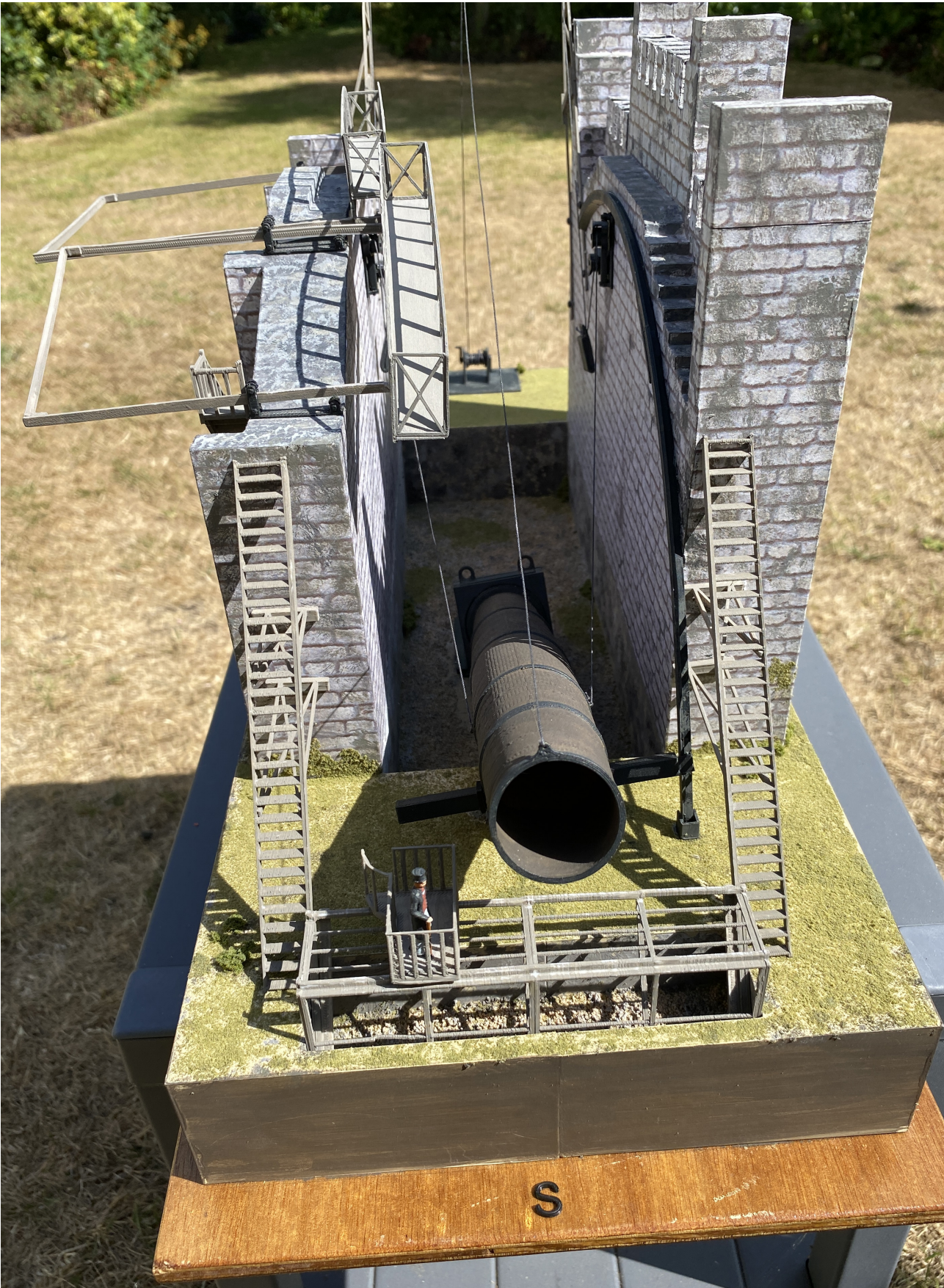
The final model (excluding access stairs). Well not quite. This is the final build, now comes the 'decorating'

We found a print of stonework that although not 100% accurate would do the job. Several sheets were printed and stuck to the walls.

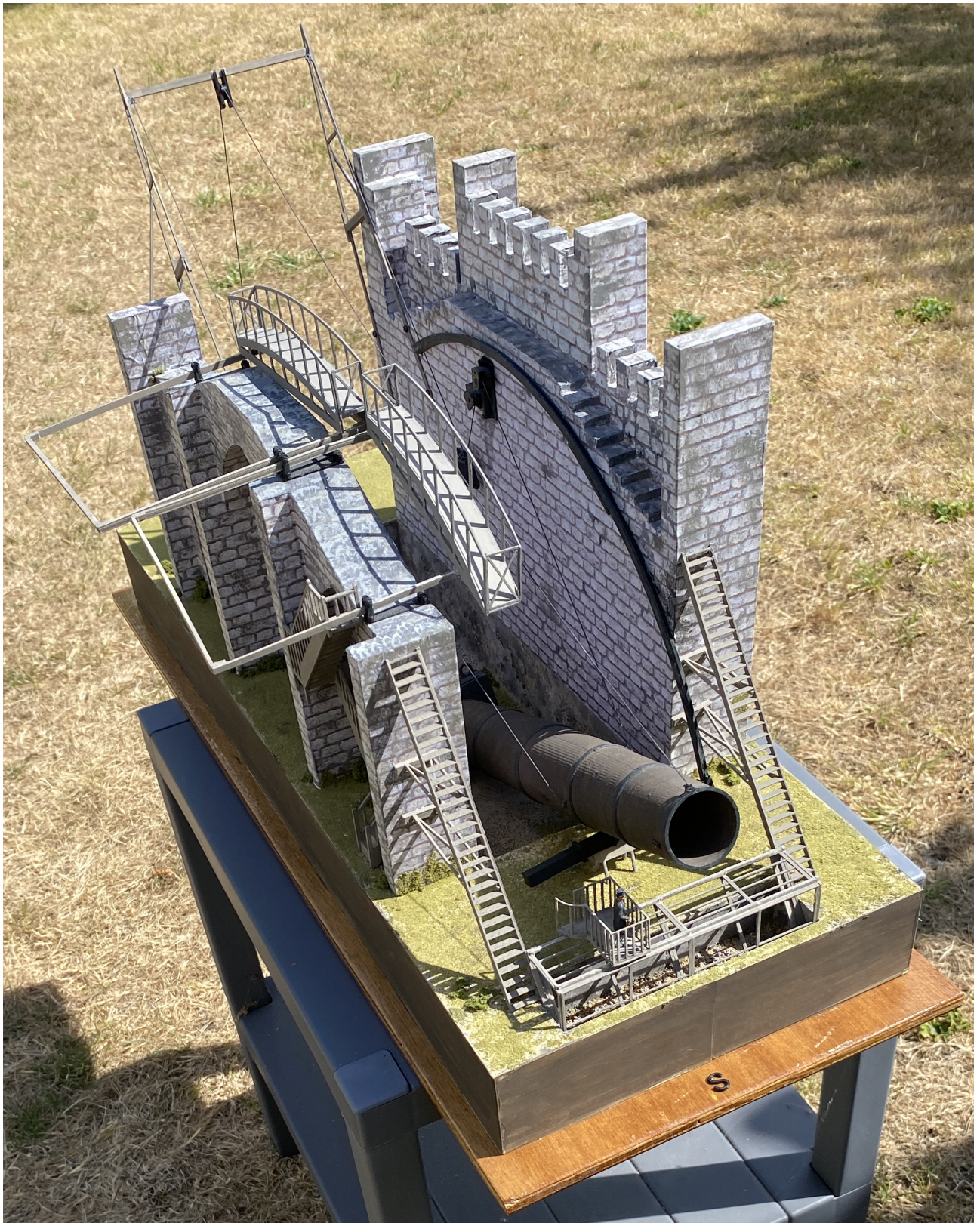
Sue used some modelling 'grass' for the top of the ground. Various other parts were suitably painted.



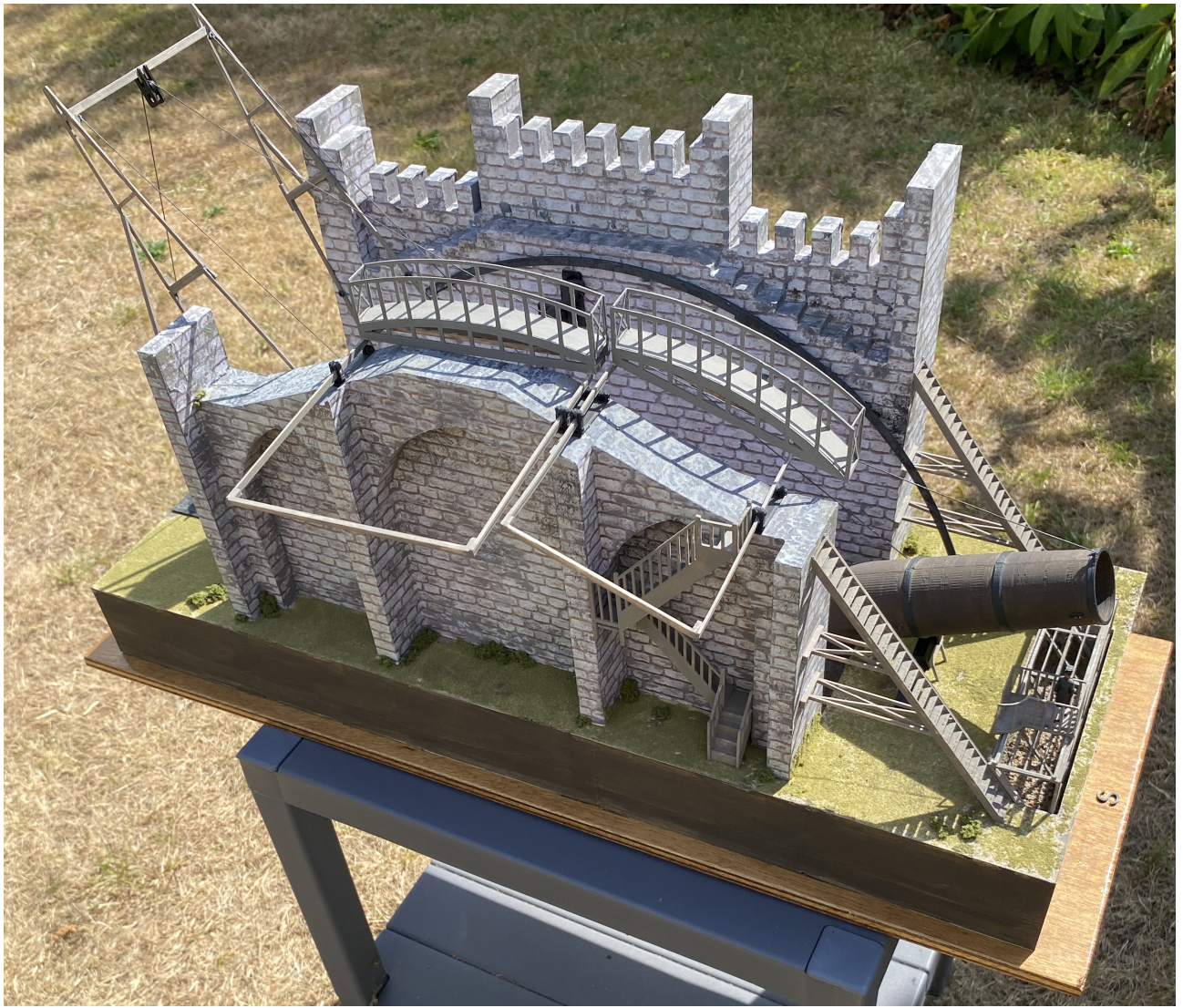
The Complete Model















Detail of the counterpoise and mount. 'A' frame to the left.

For more details of the great telescope see <https://birrcastle.com/the-great-telescope/>