My final project is based on a classic 1825 German three-draw telescope[1]. While my SolidWorks drawing was heavily based on the look of this German telescope, I took several liberties in the dimensions and made several simplifications in the lenses and assembly. Figures 1 and 2 show the telescope collapsed and expanded.

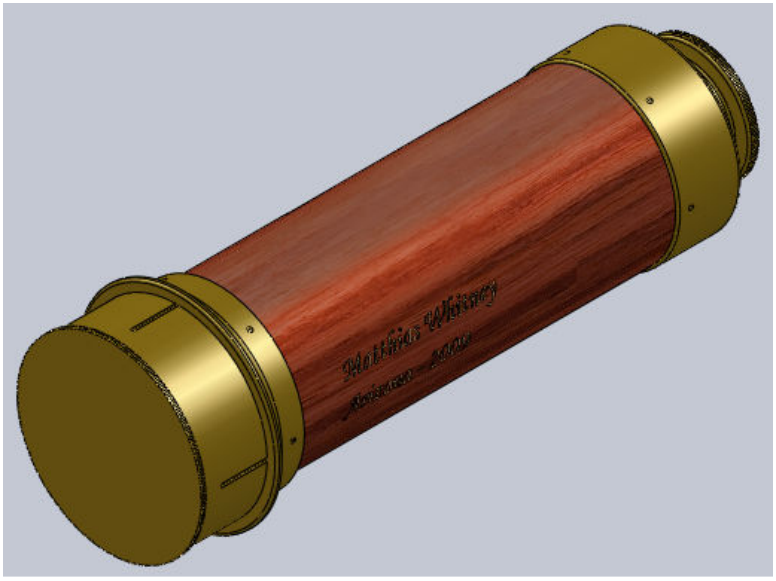

Figure 1. Isometric view of collapsed telescope.

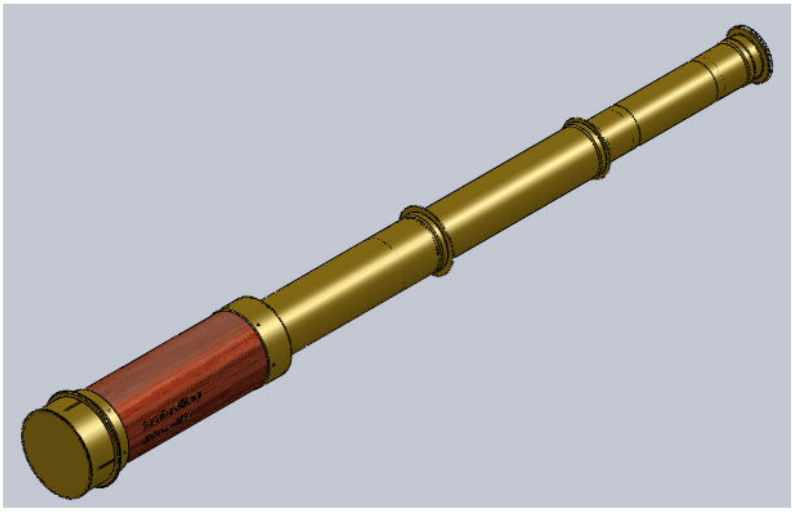

Figure 2. Isometric view of expanded telescope.

The telescope is comprised of 19 parts including four tubes, five lenses, a removable objective lens cover, a moving eyepiece cover, and other mechanical parts. Figure 3 shows the exploded view of the telescope.

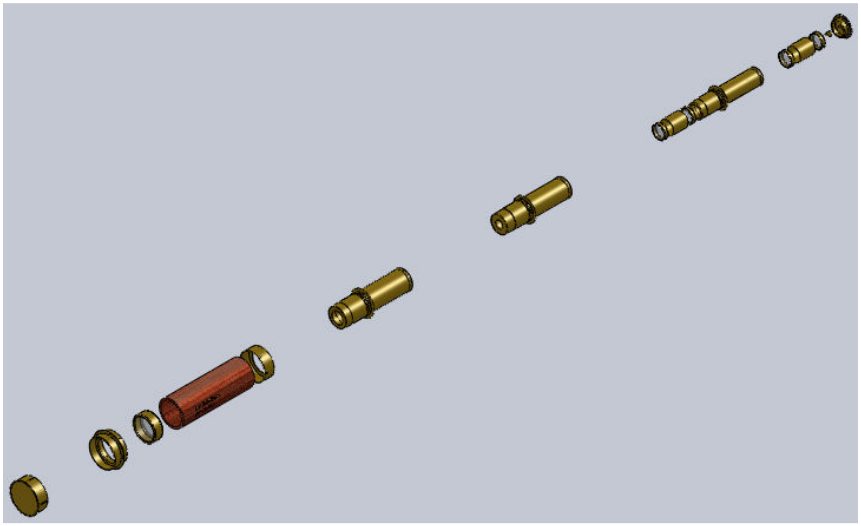

Figure 3. Isometric exploded view. See drawing for further detail of exploded view.

The four tubes were made with a simple extrude boss/base feature. The three brass tubes also required further drawing for the mechanical stop and end ridge. Gold lettering was etched on the body of the main wooden tube. This was achieved by using the wrap feature to wrap the text around the tube circumference. See figure 4.

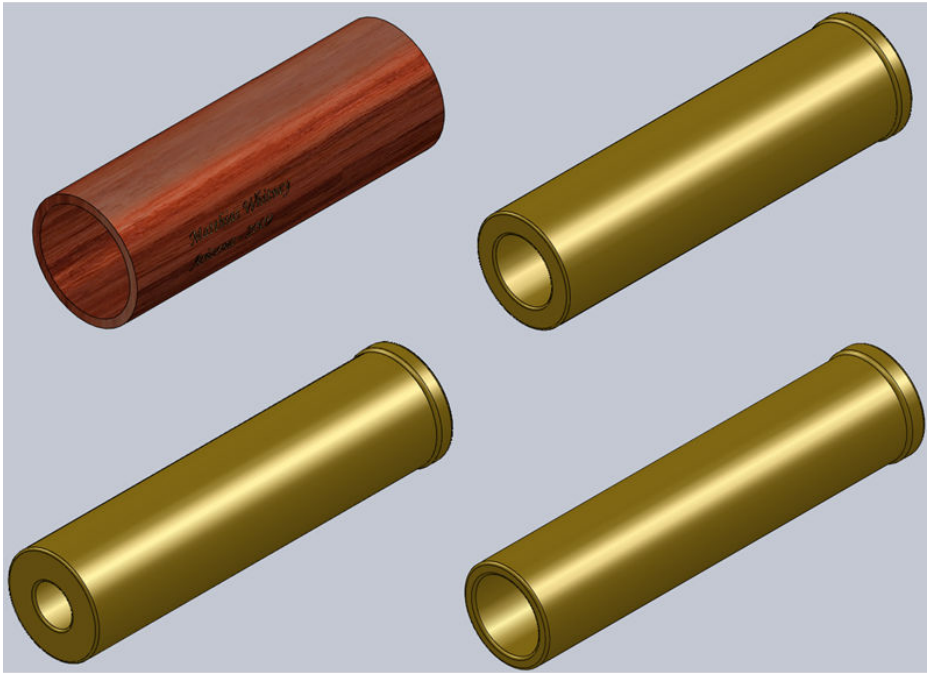

Figure 4. Four tubes of telescope.

Each of the end pieces of the main wooden tube as well as the objective lens cover were drawn by revolving a sketch. The scored pattern on the edge of the lens cover was created by extruding a very small cut, then using the circular pattern to copy it around the circumference 160 times. The four slits in the lens cover were also extruded cuts which were patterned circularly. The tiny screws on the end covers are not individual parts, but drawn on. This was achieved by drawing the screw on a reference plane tangent to the main body of the tube ends,

then using the wrap feature to wrap the drawing of the screw around the circumference. Then a circular pattern was used to copy the screw around the parts. See figure 5.

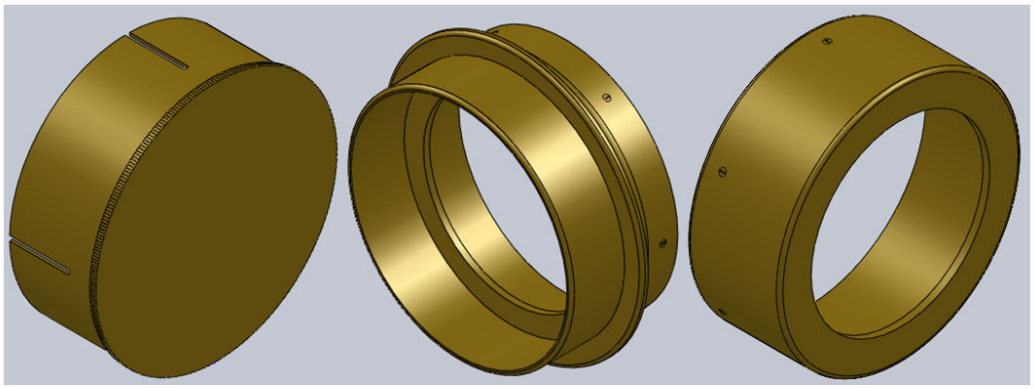

Figure 5. Objective lens cover and main tube end pieces.

Each of the brass tubes contains a "slider" part. Each of these parts were drawn with simple extrude features. The threads were drawn by sweeping the thread profile along a helical pattern. The scoring was made similar to that of the objective lens cover by extruding a small cut, then using a circular pattern to copy it several times. Each of the sliders were made the same in different sizes. See figure 6.

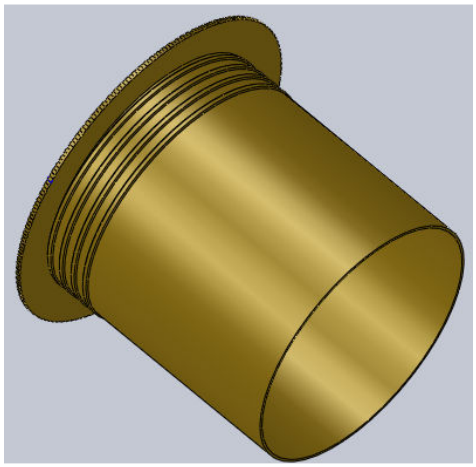

Figure 6. One of three tube "sliders" used in the telescope.

The objective lens, as well as the eye and relay lenses, were made by drawing the outer mechanical part with a revolve, using the shell feature to hollow it out, then revolving the shape for the glass portion of the lens. The transparency effect was achieved by choosing glass as the material for that feature in the "RealView" task pane. For this assignment, both eyepiece lenses and relay lenses are all the same lens. The lens tube holding the two eyepiece lenses and relay lenses together is a simple extrude. See figures 7 and 8.

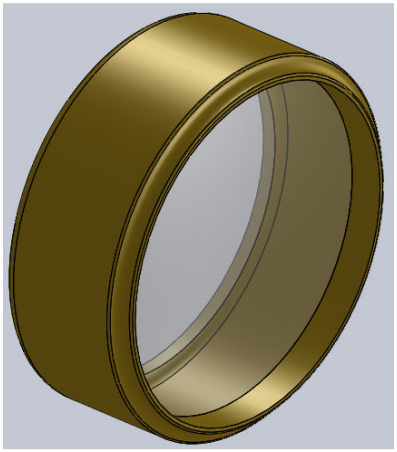

Figure 7. Objective lens.

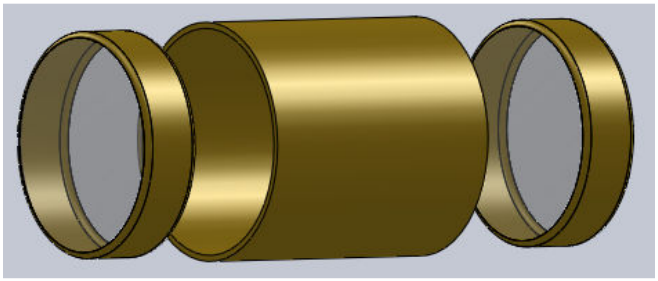

Figure 8. Eyepiece/relay lenses with lens tube.

The eyepiece was made with by shelling out a revolve, then extruding the proper cuts for the rotating eyepiece cover. Again, the scoring was made by extruding a small cut, then copying it with a circular pattern.

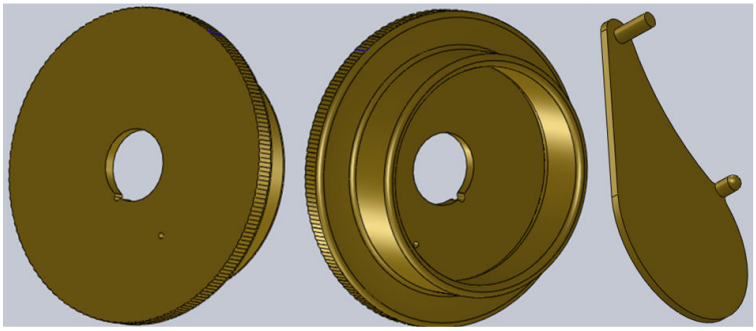

Figure 9. Front and back view of the eyepiece, with rotating eyepiece cover.

As illustrated in figures 1 and 2, the three-draw telescope has a collapsed and expanded configuration. In creating the assembly file for the telescope, each part was constrained to move only in the direction it was meant to travel for expansion and collapse. The tubes were mated using advanced mates to constrain their travel as to not over draw or compress beyond its regular travel. The objective lens cover was also mated with an advanced mate to limit its travel. The eyepiece cover was mated with an advanced mate to limit the angle its rotation angle from either entirely opened or entirely closed on the eyepiece.

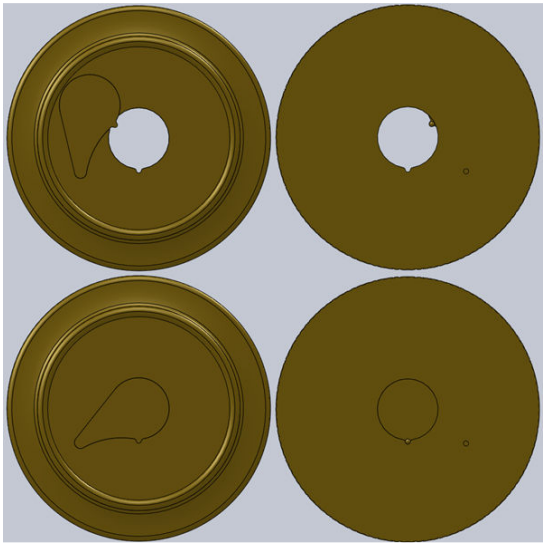

Figure 10. Front and back views of the eyepiece and cover in opened and closed configurations.

Acknoledgments and References

1. Special thanks to Brian Wheelright for allowing me to view, disassemble, and measure the three-draw German telescope, as well as providing me with numerous photos. The telescope resides in the Meinel Optical Sciences building at the University of Arizona in Dr. John Greivenkamp's collection of antique optics. Photos of the telescope can be seen at http://www.optics.arizona.edu/antiques/Telescope/Catalogue/T18/T18.htm.