Designing the Future of Amateur Astronomy: 3D Printed Telescopes

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Abstract

This research delves into the symbiotic relationship between engineering and astronomy through the reengineering of telescopes, emphasizing user-friendly design and cost-effectiveness. Focused on an 8-inch primary mirror and a 1.75-inch secondary mirror, our objective is to streamline the telescope's functionality for the benefit of engineering and astronomy students. Employing a systematic engineering design process, we are currently designing the telescope to be 3D printed with PLA filament, eventually culminating in a collapsible telescope structure. It will be supported by aluminum extrusion and secured with hexagonal endcaps. This design ensures easy handling and facilitates cost-effective production, with spare parts readily reproducible. The outcome integrates principles from astronomy, physics, and engineering, serving as an innovative educational tool and creates more accessibility for students outside of the field who are financially disadvantaged. By combining accessibility, performance, and affordability, our telescope design aims to enhance the interdisciplinary collaboration between these fields while providing an exemplary model for cost-effective engineering projects for students outside of the university.

Design Considerations

To create the best possible telescope with the existing mirrors, three main concepts were in mind:

1. Modularity
2. Adaptability
3. Cost Effectiveness

The largest constraint on our design was the primary and secondary mirror. With an 8-inch f/6 primary mirror, a focal length of 1220 mm is produced giving us a minimum length dimension.

The rest of the telescope needed to be created from PLA and 20/20 Aluminum Extrusion.

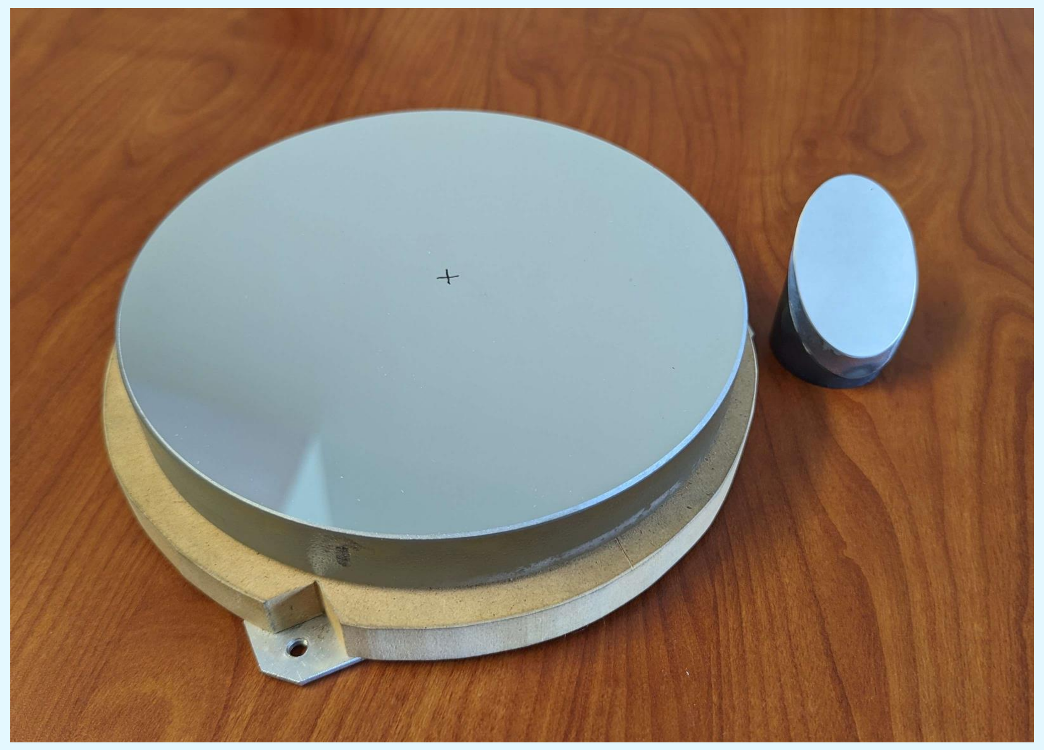

Figure 3: Photographs of Mirrors with Center Point and Secondary Visible

Design Process

1. Identified constraints and created design principles
2. Researched and took inspiration from existing designs
3. Brainstormed ideas and created initial drawings
4. Created individual part designs in Fusion 360
5. Assembled the parts in Fusion 360
6. Manufactured and organized parts
7. Constructed prototype

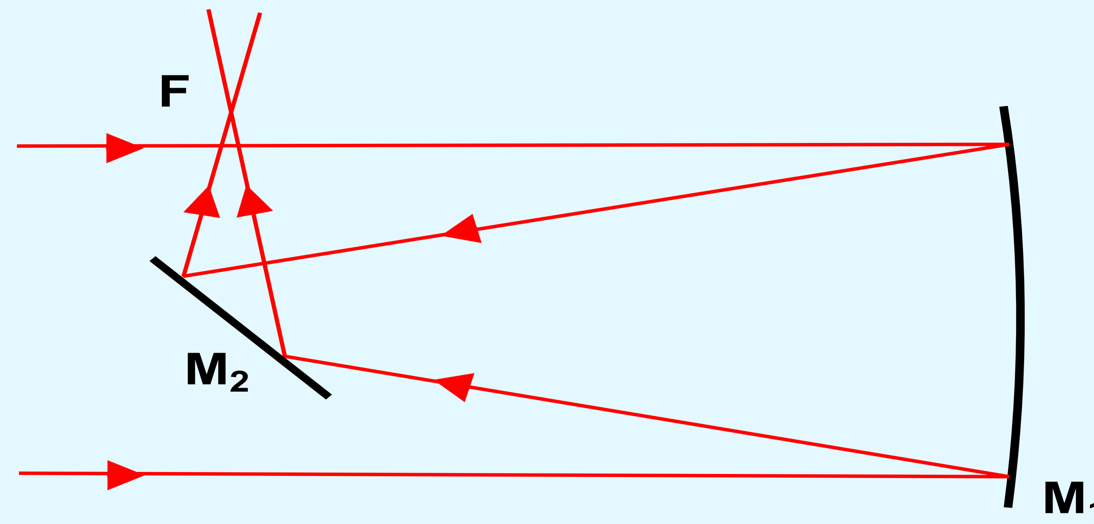

Figure 4: Diagram of the Dobsonian Reflector [1]

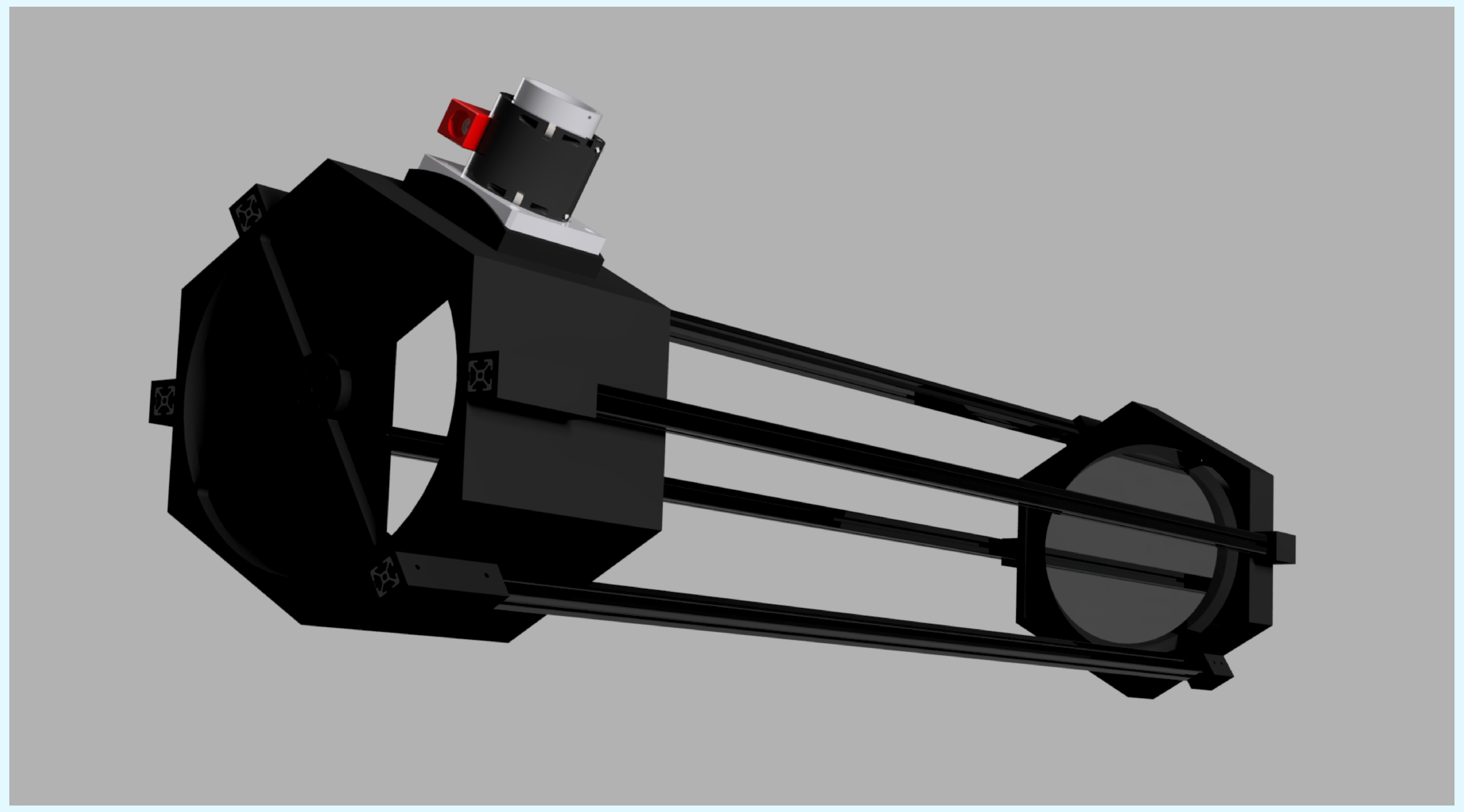

Figure 1: 3-D Model of the Telescope, Side View

Rendering of open telescope barrel

Down barrel view

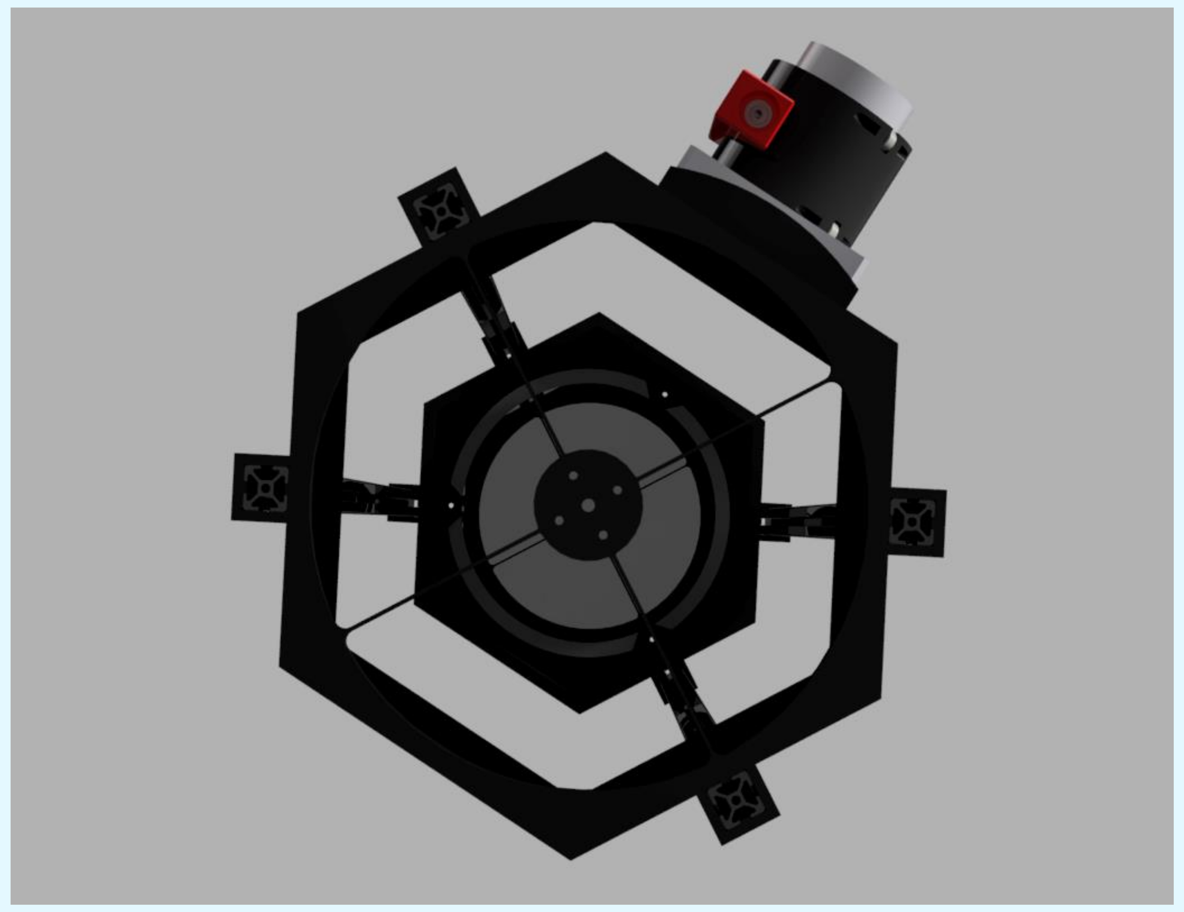

Figure 2: 3-D Model of the Telescope, Front View

Applications

Easily replicable design, useful for teaching:

- The engineering process
- CAD and other design techniques
- 3D printing
- Modular design
- Optics

Low-cost design creates opportunities for education and use in areas where the purchase of a telescope is not feasible.

Upcoming plans include outreach via events with the Amateur Astronomy Club and working with the Daytona Beach Museum of Arts and Sciences.

All files will be made public shortly after the testing phase concludes, ensuring high accuracy. Testing will continue with a variety of materials and styles.

References and Acknowledgements

[1] Hahn. (2010, April 1). *Diagram Reflector Newton*. Wikimedia Commons. https://commons.wikimedia.org/w/index.php?title=File%3ADiagram_Reflector_Newton.svg&oldid=597367674.

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