

Donald P. Shiley School of Engineering
EGR 491 Telescope Design, Fall 2019
Assignment 2 – Telescope Design Options

The main purpose of this assignment is to help you become familiar with telescope design options.

- 1) Before we begin the technical side of this homework, what is the etymology of the word “*amateur*”?

Telescopes consist of two main components and several subcomponents. What is the purpose of the following main components? Briefly discuss each (a sentence or so, each), and include sketch(es) as helpful.

- 2) The optical tube assembly (OTA)
- 3) The base or tripod

The optical tube assembly of a Newtonian reflector consists of the following. What is the “job” of each (what purposes do they serve).

- 4) Primary mirror
- 5) Mirror cell (for primary mirror)
- 6) Secondary mirror
- 7) “Spider” (for the secondary mirror)
- 8) Focuser

What makes telescope design particularly interesting is that there is a wide variety of designs that all accomplish the same basic task – make often-faint far-off objects visible. Optically, there are three basic designs: refractors, reflectors, and catadioptric. But telescopes design involves more than optics. Briefly discuss each of the following (a sentence or so, each), and include sketch(es) as helpful.

- 9) Briefly, describe the differences between refractors, reflectors, and catadioptric telescopes.
- 10) In astronomy, what is meant by altitude of an object? What is meant by azimuth?
- 11) What is meant by *alt/az* mount?
- 12) What is meant by *equatorial mount*?
- 13) Describe the main advantages of equatorial mounts compared to alt/az, and main advantages of alt/az compared to equatorial mounts.
- 14) John Dobson introduced a revolutionary design philosophy for ATM’s (amateur telescope makers). Write a short (several sentences) biography of John Dobson (Wikipedia is fine). He’s an interesting character.
- 15) What was this “revolutionary” design philosophy? In other words, what characterizes a “Dobsonian” telescope?
- 16) Design is often a revolution followed by evolution; significant changes followed by subtle refinement. Dobsonian telescopes have evolved since they were introduced in 1965, and continue to do so. There are unlimited options to designing the structure of the optical tube. As long as the optics are held in place, and some mechanism is provided to point the scope at the sky, the telescope will meet its purpose. However, we can identify four primary “classifications” to Dobsonian telescopes: solid tube, “solid pole”, truss-tube, and string. Briefly, discuss pros/cons of each – speculate if you need. Photos of examples are provided below.



Solid tube



Gary Seronik's four solid pole scope.



Truss-tube



Dan Gray's string telescopes (first string telescope, at left, 1998)

17) If you closely observe the images above, you will notice that besides a difference in the optical tube structure, there are two variations on the alt/az design. Both the "solid tube" and Gary Seronik's telescope have a solid, boxy alt/az mount, whereas the truss-tube and both of Dan Gray's telescopes have a much lower and more flexible, less boxy alt/az mount structure. Speculate on the pros/cons of these two different alt/az designs.

18) To some extent, you've already done work on this "problem" – but a little more is good...When beginning any design, the first task is to understand the problem. The more familiar you are with existing similar designs, the easier it is to achieve this. One way to become familiar is to be a user of the product. If you are designing a fork lift truck – experience with driving and repairing one would be good. So would manufacturing experience. Also, familiarity with different manufactures products would help. Hyster-Yale has different design details than Toyota lift trucks. For this assignment, spend some time "googling" ATM (amateur telescope making). Be sure to review some designs of two local ATM'ers. Mel Bartels is literally a world famous ATM'er, and lives near Eugene. He has very innovative ideas and has spent thousands of hours designing and building telescopes. Mel runs the "telescope walkabout" at the Oregon Star Party. Also, review Don Peckhan's page (<https://www.dbpeckham.com/>). Don lives in Vancouver, Washington, and helps with the Rose City Astronomers Telescope Workshop (on Swan Island). Don worked for Hyster (lift trucks), and his structural engineering talents are evident in his telescopes. Don't worry about details at this point – just see what is out there, details will come later. There is nothing to submit for this "question."

Mel Bartels: (<https://www.bbastrodesigns.com/tm.html>)