ATM Journal 1: Introduction and Design Notes
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This article is the first in a series that will describe my ongoing efforts in Amateur Telescope Making as well as exploring what others are doing in this exciting and rewarding branch of amateur astronomy. Without question if you're minimally handy and able to use hand tools, you can build a telescope for a fraction of the cost of a commercial scope, and probably end up with a higher quality result for your efforts.

A little about me - My first real telescope (other than a junk Tasco 3" department store scope) was a 13.1" Dobsonian built by my father and I when I was a teenager in the early 1980s. The design was a direct copy of the Coulter Oddessey 1 telescope. After using this scope for 20 years, making various modifications as I went, I decided I wanted to finally get my feet wet in astrophotography, particularly the very exciting areas of digital and web cam astrophotos. The 13.1" needed a complete overhaul to replace it's sonotube Optical Tube Assembly (OTA) and plywood components with something a lot lighter. After investigating options for computerizing the scope (including the excellent Bartels computer control system www.bbastrodesigns.com) and a few attempts at prototyping a truss tube scope I decided finally to sell off the components of the 13.1" scope and build from scratch - I decided to build an 8" prototype (which would become a planetary scope) then a 16" for deep space observing, mounted on the same permanent mount. Indeed, I decided (masochist that I am) to endeavor to build from scratch, rather than buying components, where possible.

So whats the first step? Design and research, obviously. The web is a wonderful tool for this, with hundreds of telescope designs available, including some complete plans (see www.atmsite.org). Since a telescope building project will result in a telescope perfectly suited to it's intended use, it is a very good idea to make sure that that one has a clear set of goals. Some criteria are:

Portability - The best scope design in the world is one that gets used! Hence, one must decide whether to build something that is portable enough to haul out to an observing site (such as a truss tube Dobsonian) or do without portability.

Anticipated Use - Lunar and Planetary or Deep Sky? Searching for comets? Imaging or visual observing? This will influence both optical and mechanical design, as we will see.

Cost - While a home built telescope will be substantially cheaper than a store bought alternative, the build costs of different telescope optical and mechanical designs will vary wildly.

Materials - Wood, metal, composites? This decision is normally driven by the skills and available tools of the telescope builder. Most amateurs build from wood since hand tools suitable for woodworking are commonly found in most workshops, or metal (often aluminum) if they have tools and experience in working in this medium.

Complexity - For the most part, amateurs start by building Newtonian reflectors since there's only two optical surfaces involved and the telescopes are mechanically fairly simple. Other reflector designs such as traditional cassegrains or refractors are far

more rarely seen. Mounts range from the simplest Dobsonian (alt-azimuth) designs to more complex equatorial designs.

These criteria considered, most ATMs opt to build (at least as a first telescope) a Dobsonian of between 6" and 8" aperature. For the purposes of this series of articles, I' ll describe the process of building an 8" f5 telescope using a Dobsonian mount. This telescope will be as portable as possible (with a focal length of 8" times 5 or 40"), will be general purpose enough to perform well in visual (untracked) planetary and lunar as well as deep sky observing (although the focal ratio will favour deep sky observing, a trade off required to minimize tube length), will be built from plywood and a simple open tube design using string trusses to minimize costs, make it easy to build, and maximize portability. Conveniently I have an 8" plate glass grinding "tool" allocated to be incorporated into exactly this design for taking to RASC events and the lake. I' ll likely build this telescope concurrently with my main project below.

In addition to the 8" f5 telescope I' ll relate my experiences building a 8" f10 dedicated planetary telescope to take advantage of excellent prospects for planetary viewing in 2003. This telescope will be very different from the average 8" - first, it will be a long focal length instrument so that the field of view is reduced, concentrating the light gathering capabilities of the telescope over a narrower field of view. Second, the long focal length allows the size of the secondary mirror to be minimized. The secondary on a Newtonian telescope is in the same path that light takes to get to the main mirror, so it will obstruct a certain amount of light and thus reduce the effective aperture. Finally, reducing the secondary size will reduce diffraction, maximizing the ability of the observer to resolve small details.

One trade off of a long focal length is physical dimensions - the tube for this instrument (which has a focal length of 80") will be approximately 85" in length, which is quite considerable. Also, to provide accurate tracking for planetary and lunar imaging, the telescope will be mounted on what I consider the most stable equatorial mounting available, a classic horseshoe mounting. So, this design has abandoned portability entirely. The mounting will be constructed from wood (since I lack tools and experience in metal) and will incorporate many wrinkles that we will discuss as we progress to reduce cost and complexity.

Next time: Pushing Glass: Grinding your mirror