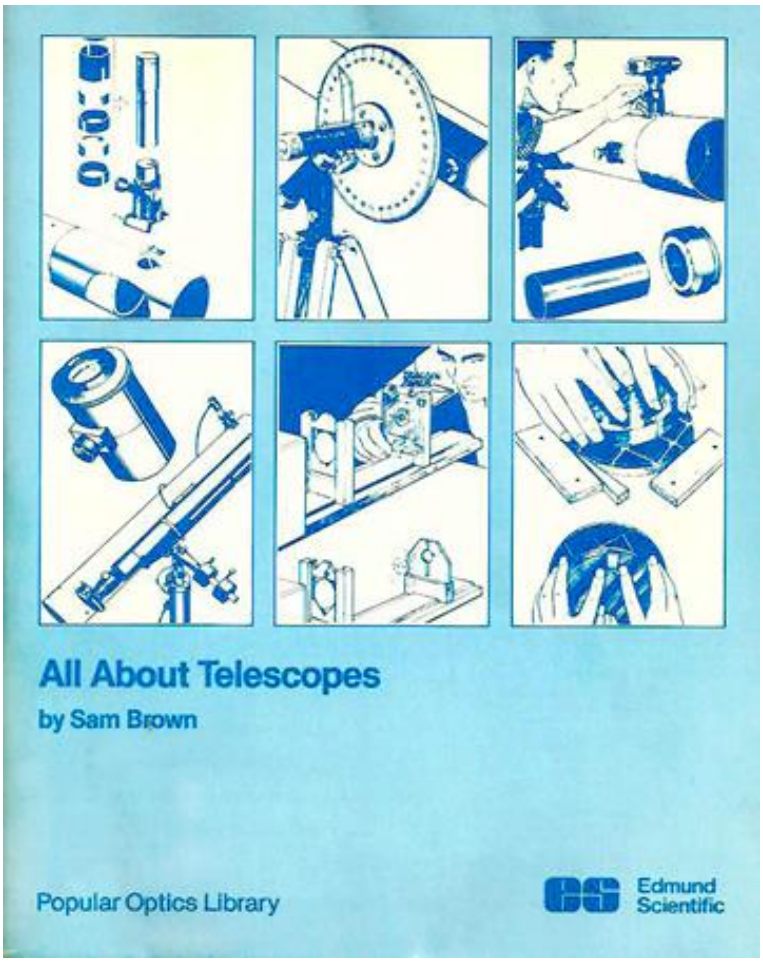
All About Telescopes by Sam Brown, A Retrospective

By Dick Suiter

In the 1960s, Edmund Scientific Company used to be the source of a great catalog of desirable stuff. A partial list included surplus optics, magnets, magnifiers, amateur telescopes, microscopes, and all sorts of scientific gizmos and classroom demo items. Edmund had not yet morphed into a competitor to the professional optical companies such as Melles-Griot or Newport. When it did, it chose to spin off the toy and education elements to a separate entity, much reduced in extent, and the surplus optics to yet another distributor. I don't know how separated from Edmund Industrial Optics these companies really were (they may have been only internal divisions), but they allowed the main company to clean up its amateur image and become the optics juggernaut it is today. As surplus optics continued to dry up from the original deep wells of WWII, the surplus lens company withered and Edmund is selling the remains on its "Clearance" page. The toy and education company still exists, but the website is a poor shadow of the original catalog, selling mostly "science museum crap" (you know what I mean). Even the beloved Astroscan no longer has a bulbous back end. Now it's a clone of the Orion Star Blast.



The cover of my 1989 8th edition of Sam Brown's ***All About Telescopes***

I can still remember the hours of pleasure (and frustration) reading the Edmund Scientific catalog during the late 1960s. I kept adding up variations of the cost of 6-inch telescope parts and mirror kits, and still could not make them sum up to less than about $110. If I was willing to settle for a 3-inch *f*/10 cardboard-tubed reflector, I could get it for the princely sum of $30 plus shipping and handling. This scope was the extravagantly named **Space Conqueror**. There has been roughly a factor of 5 to 10 inflation since 1968, depending on the commodity or item you are talking about, so $30 for a 3-inch does not seem so cheap (minimum-wage pay was then about $1.00/hr). I'd already learned enough about astronomy to realize that a 3-inch aperture was only barely adequate. It would only whet my appetite. I had no money, and I saved most of the tiny amount I did scrape up for college. As long as I was wishing, I might as well hope for the $200 6-inch **Super Space Conqueror** (you can hear the diminishing echoes…) or the $389 8-inch reflector with its gut-busting cast iron equatorial mounting. I made a few purchases from the catalog, but they were unrelated to telescopes.

In preparation for the day when I would collect enough coins to at least commence buying parts, I could still read. My school library had a paperback copy of *How to Make a Telescope*, by Jean Texereau, and I kept it checked out full time while I memorized it. My enlightenment arrived at that moment when I finally understood the Foucault data reduction and analysis section (I heard singing), but it took a year for a high school student.

About this time, I also came across the Edmund publication ***All About Telescopes*** (henceforth known as AAT), by Sam Brown. A number of separate Edmund pamphlets had been collected together to make the book. They included telescope making, telescope use, graphical ray tracing and optics in general. Founder Norman W. Edmund was an early collaborator on some of this work, but he appears to have graciously stepped back and let Sam take all the credit in later editions. AAT gave not the state-of-the-art in 1967 (1st edition), but what could be done with simple tools in the fifties to early sixties. This was telescope making for the rest of us, for those without screw-cutting metal lathes and milling machines in our basements. It was for those who hadn't tried aluminum sand-casting and didn't want to. It was in the days before pocket calculators, before personal computers, and before search engines.

What made Sam Brown's vision unique was the idea of the "possible" telescope. When you are an impecunious teenage nerd in 1968 and you badly want a telescope, there isn't much you can do but generate pitiful schemes about unlikely manufacturing ventures. Let's face it; the idea that an isolated kid can make a useable mirror is pretty far-fetched. It could be done, but it's more likely to be dropped (figuratively or even literally). Brown's book had mirror grinding instructions, but it had a lot more parts-assembly telescopes that didn't look that difficult to make. I particularly like the telescopes-on-a-stick of pages 76, 86, 98, and 99. As it turned out, I never got around to attempting one, since my observing was diverted to a binocular. However, the idea that comforted me was that if I could scrounge a main optic, I was only a non-scary bit of work away from a telescope. Maybe a drill press would be handy to get better alignment of screw holes, but a full machine shop was not needed.

The thing about AAT that was different than other telescope-making manuals was the tendency to view the topic at a wide scale. In one section, there are descriptions of the assembly of about 25 telescopes tubes, each about a page long. That wouldn't have normally been enough, but wonderfully detailed line-art drawings accompanied each one that gave you the impression you could successfully complete each telescope just from the sketches alone. I have never tried to exactly reproduce an AAT telescope, but a lot of Brown's philosophy of telescope making has sunk into me, especially in my use of "repurposed" materials. My 10-inch Dobsonian has window latches, screen door handles, and piano hinges.

The first section of the book is instructive and densely packed with how to calculate eyepiece math, what diffraction limited performance is, what the magnitude scale means, and how to align an equatorial mount. It has power arithmetic, Barlow lenses, what and where to look for targets, and the Greek alphabet. It has setting circles, a homemade solar-projection box, photography, eyepiece projection math, and so forth. A helpful later section of the book explains how to square and balance telescope tubes. A lot of this stuff has appeared this compactly nowhere else, or little bits of it are scattered through many books.

A good example is the section on photography. While seemingly archaic in that it follows the 35-mm film-emulsion system exclusively, there are nuggets that are still of value. One example is Table 2 on page 57, labeled *Image Size.* In this table we can find out that objects occupying the angular dimension of Jupiter (about 40 arcsec) expanded through an effective focal length of 300 inches, still are less than 1/17th inch or 1.5 mm across. This size is about the minimum useful for a 6.6x8.8 mm ("2/3-inch[1]") imager. Also good is the compound lens math that allows you to figure the effective focal length of an eyepiece projection setup.

Following the tube assembly descriptions, a series of telescope mountings are given. Most of these are really terrible, but we can't blame Sam Brown for them. Particularly bad were the pipe mountings. These were common through the sixties. You took was a set of steel pipe elbows, tees, and short straight pieces and constructed a tinker-toy mounting out of it. We have forgotten in these days of PVC pipes, but steel is what drain pipes were made of in the old days. These steel pipes were threaded with a tapered tap and die system. The taper meant it was always too loose in one direction and too tight a half turn on the other side. Plumbers didn't care; they always soldered it shut.

Better bearings could be made by not using the threads to hold the scope, but building a shaft axle running through a bushing and tee fitting, relying on Devcon plastic metal bearings to provide the bearing contact. This

is one procedure Mr. Brown fails to explain well. Presumably you cover the interior (deliberately-loosened) shaft with mold release compound (he recommends Vaseline), assemble the bearing and inject the crack with the plastic metal epoxy (or maybe you smear it on right before assembly). If it doesn't work and you wish to try again, you heat the bearing up with a torch and the plastic turns to powder. The altazimuths were all one-sided affairs that must have acted like undamped springs (the Texereau fork was better even then). If we forget now just how revolutionary Dobson mountings were, just look back to ***All About Telescopes*** to see just how it was in the bad old days.

Another piece of the book that is somewhat antiquated is the section on setting circles. A lot of it is theoretically interesting, but not much used in these days of digital setting circles. I don't know how much these instructions ever applied; in the days before digital circles, the only circles I ever liked were 3 feet in diameter. Still, you should look through the procedure to familiarize yourself with concepts like right ascension and hour angle and how those relate to clock time and sidereal time. It is useful to see what all is packed behind the front panel of those digital controllers.

Just what is it about Sam Brown's work that makes it so attractive? It comes down to the graphics. Not that it is high art; he was a workmanlike line artist or mechanical drawer. It is just that he depicted the item he wanted to draw from the ideal angle and had just enough detail to illustrate his point, not too much or too little. He used cutaway and breakaway drawings where appropriate. If he intended the surface to be made of wood, he drew it with wood texture rather than told you about it. He also didn't talk about the pictures excessively. He let each picture relate its thousand words.

There have been a few other skilled illustrators. Texereau himself comes to mind, as does Russell Porter in the drawings of the 200-inch Palomar reflector and the ***Amateur Telescope Making*** books edited by Albert G. Ingalls. Finally, who can forget Roger Hayward, whose many drawings for ***Scientific American*** gave the *Amateur Scientist* column its look-and-feel for decades. Hayward also illustrated John Strong's ***Procedures in Experimental Physics***, resulting in universal admiration of that book. (Strong is the investigator who worked out the technology of vacuum deposition of aluminum coatings on telescope mirrors.)

In the years past his death in 1976, Mr. Brown's book took on some revisions. The first was that Edmund was backing out of the amateur telescope making market. Slowly, over time, the Edmund part numbers disappeared from the little tables on the pages in which the telescopes were described. In an effort to modernize the appearance of the book, a couple of pictures had also been modified by adding long hair and "modern" clothing to the figures, making the readers wince. The only reason Brown had put people in the drawings of telescopes was to give the pictures scale. Ham-handed meddling with their appearance drew more attention than it was worth. Sure, the originals were geeks, but so were we. Ironically, fashionable men's hair lengths soon returned to fifties shortness, or even beyond. Such revisions didn't interfere with the pictures of the hardware, though.

Other people have written tributes to Sam Brown.[2,3,4] Reference 2 says he is the "world's greatest technical writer." I wouldn't quite go that far, but I would admit him to the ranks of those who are also fine technical illustrators (I know I am not among them). If you want to feed a sense of nostalgia, AAT seems to be out-of-print, but you can still obtain used copies on Amazon. You have to perform a very un-Brown-like action to get a copy, though. You have to pay a premium price!

1) This seemingly too-small image rectangle inherits a generous ring of dead space on the outside for an old-style TV vidicon-tube wall.
2) Circuitous Root Blog: 2012, 2015 by David M. MacMillan and Rollande Krandall
http://www.circuitousroot.com/artifice/resources/biblio/sam-brown/
3) Cloudy Nights thread: various authors
http://www.cloudynights.com/topic/321079-edmund-scientific-and-sam-brown/
4) Cloudy Nights thread: various authors
http://www.cloudynights.com/topic/478975-all-about-telescopes-by-sam-brown/