The Solar Observation

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Dateline:
May 7, 2005, 8:30 AM – Eugene, OR

Purpose:
Midwest Chapter hosts a Solar Surveying seminar

Forecast:
Rain off and on for the last week. Number of calls asking if the seminar is still on—heavy.

WHAT ELSE WOULD ONE EXPECT OF SPRINGTIME IN OREGON? Yet it's not that surveyors are particularly averse to taking a field seminar in the rain. It's just that a solar seminar might not be as stimulating or educational sans sunshine.

This seminar, conducted by Tim Kent (formerly of the Bureau of Land Management and now an instructor at OIT), teaches present-day surveyors the methods, instruments, and techniques used by our predecessors in running PLSS boundaries. Tim has at his disposal the BLM store of solar instruments used down the years. As we enter the classroom, we see a quotation by Deputy Surveyor John Fitzhugh prominently displayed. It says "The solar compass is a fine instrument in the hands of an astronomer or mathematician. When in perfect order its results are quick and reliable, but under control of an 'ignoramus' it is the wildest 'machine' that was ever used to trace a line."

Tim starts his fast-paced class indoors with a morning classroom session. First we examine the different types of instruments—solar compass and solar transit. We discuss their differences and how each developed. To this author the solar compass does in fact resemble a "wild machine" that looks like some secret decoder ring for celestial navigation. Next comes a dissertation on solar declination—the apparent yearly path of the sun north and south of the equator; the determination of longitude and latitude at apparent solar noon; and some calculations associated with each. Tim does spare us the intricacies of solving the spherical triangle trigonometric functions. You know the one! The PZS spherical triangle! Sure? The intrigue comes when all of these factors, properly combined, allow the observer to solve that pesky spherical triangle within the instrument itself. Solar north is determined without the HP48.

Kent's lecture covers a fair amount of history of the early Oregon PLSS surveyors and is followed by an explanation of how they did the actual surveys of our revered township and section lines. Chaining techniques, sample trig table calculations, offset and obstacle calculations are all reviewed in earnest anticipation of our afternoon field challenge. The final portion of the morning session was the "reading of the vernier." Since time was running short and the sun doesn't wait (not even for surveyors), Kent asked the group if we were okay with our vernier-reading abilities. The "gray hairs" all nodded affirmatively. Not wanting to appear naïve, the "not-so-gray hairs" shrugged and nodded yes. Then each crew gathered their gear and headed to the field in search of "true north."

Dateline:
Noon – Fern Ridge Reservoir, Eugene, OR

Purpose:
Field solar observation and chaining demonstration

Weather:
Cloudy, threatening to rain

TIM GOES OVER SOME GROUND RULES IN THE CARE AND USE OF the equipment. He suggests that these instruments have seen some rain in

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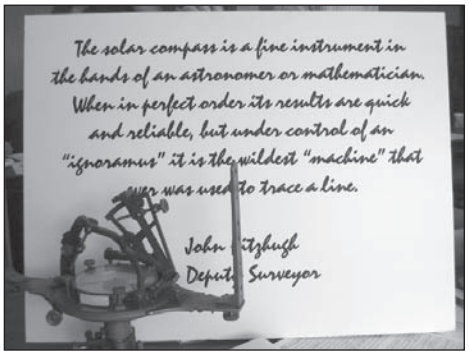
their day, so not to be too concerned. We set up on predetermined baselines and diligently adjust our instruments to the proper latitude and declination readings, which were determined in the morning session. Without sun, we either approximate or use magnetic north to replicate the baseline direction. We follow this with a short chaining exercise between two known points.

After some amusing chaining mayhem, each team demonstrates their sudden, or renewed, prowess and heads toward a known point. We're feeling pretty competent by now; but then there is a new wrinkle in the form of an imaginary "swamp" or "river" to be crossed. The rule is we cannot "wade" across with the chain. So by leaning on the morning's discussions, and leafing through some historical reference materials given as handouts, each team must devise a method to cross this obstacle. Should one use a known-distance chaining method, similar triangles, or suffer through a trig calculation without calculators? Our forefathers weren't packing 48s. As you might imagine, our chaining prowess became rather sheepishly slow. Only with lots of arm waving and head scratching did each team arrive at the appointed destination. Everyone was eager to compare measured to actual.



(above) Tim Kent (left) instructs participants on the specifics of solar observation

Then as if on command, at the appointed time clouds drift apart and the sun reluctantly presents itself for our final exam. Teams race back to the baseline, hurriedly set up and prepare for the coup de grâce—that most holy of solar grails—the solar observation.

To achieve this miraculous feat requires adjusting the compass sights with one hand, while adjusting the declination sighting arm with the other, along with the frachadise next to the knob just above the vertical doohickey. All this with the manual dexterity of the proverbial inebriated monkey. In theory, when everything is aligned in "*perfect order,*" the sun's image magically appears between the parallel lines on the mirrored observation plate and voilà—astronomic north.

Yet allow me to digress. Remember back in the classroom when all the "gray hairs" nodded yes to the vernier question? There are two such verniers that must be set precisely in order for the sun's image to appear between those parallel lines of that mirrored observation plate. Also, let me refresh us as to my previous reference to those who might be considered *ignoramus*.

Got the picture now? Yes, forty wizened surveyors—learned professionals if you will—each harboring the concern that this little sun image was not appearing between the parallel lines on the mirrored observation plate. Each one desperately wondering if they too would be mercilessly classified as *ignoramus*. Desperate men take desperate measures. Each team re-calculates, re-evaluates, and earnestly postulates on the readings of each vernier. I believe it is at this point that Mr. Kent achieves his moment of greatest pleasure. However, the sun patiently reveals to us, one by one, its magically minute image between those parallel lines on that mirrored plate. The now doubting professional is granted a reprieve. No longer an *ignoramus* but a master of the "machine." **Astronomic north is observed!!**

Talk about a sense of accomplishment. So complex, yet so simple. A single image of the sun on a mirrored plate. Who would have thought? Now, turn the angle to the baseline foresight point and read the azimuth directly.

Basis of bearing - solar observation

If you have the opportunity, I encourage you to register for Tim Kent's class on the use of solar compass and chaining. It offers a perspective that provides a real appreciation for the history and methods of the Public Land Surveying System. This author came away with a true sense of accomplishment, as well as the following realization. The Government Land Office surveyors who were paid $5 a mile were a very dedicated bunch; no wonder they were so quick to invent the transit.