The American Surveyor
A Foot In The Past... An Eye To The Future
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John Sanford, 83, of Lakewood, Colorado, may be the Last, or almost last, plane table surveyor in the central U.S.A. John purchased his alidade and plane table for $70 in 1950. John’s most recent job was a complex topographic survey of a 90 acre farm in Okmulgee County, Oklahoma, with a creek and heavy woods. This survey was completed in April, 2012. John has used the alidade for topographic surveys in Oklahoma, Kansas, Nebraska, Montana, Wyoming, Colorado, Texas, and Columbia. John also did surveying for four years in the U.S. Army, including two years in Japan doing anti-aircraft artillery surveying.

The early Plain Table (“Plain Table” prior to mid-19th century) was a mapping tool, as opposed to the compass and chain that was a boundary tool. The early use of the name, “Plain Table,” referred to its simplicity and plainness, rather than its flatness.

The earliest mention of a plane table dates to 1551 in Abel Foullon’s Usage et description de l’holomètre published in Paris. However, since Foullon’s description was of a complete, fully developed instrument, it must have been invented earlier. A brief description was also added to the 1591 edition of Digge’s Pantometria. The first mention of the device in English was by Cyprian Lucar in 1590.

By Norman G. Sloan, PS, PE, MS
The first Plain Table was constructed of wood boards placed together to form a table about 14" by 11," and mounted on a tripod. A heavy sheet of paper was attached to the top of this drawing board. The alidade is the part that has gone through the most change. The first alidade was only a ruler of brass with fold-down sights, which were like the existing compass sights. The alidade remained unchanged until about the middle of the 19th century.

The early Plain Table did not have a level bubble, but used the compass needle to level the table. If the needle was level to the table, that was good enough. The first operation was to orientate the table to the north using the compass. The next step was to sight a point of interest with the alidade, and draw a line on the board. The distance to the point of interest would then be chained.

Top: John Sanford, 83, of Lakewood, Colorado, making a survey drawing using the plane table and alidade.

Bottom: John Sanford and rodman Clay Sanford, holding the “E” rod
The next change to the plane table and alidade occurred about the middle of the 19th century. The name was changed from “plain table” to “plane table.” The alidade became a telescope. The plane table enlarged to about 2’ square, mounted on a tripod. The tripod had an adjustable mount for leveling and rotating the plane table to north. In addition, the alidade had a vertical circle scale, so that vertical angles could be determined to calculate elevation changes. During the last half of the 19th century the United States Geological Survey (USGS) used the plane table and alidade to map vast areas of the western United States.

The plane table became a popular instrument for surveying. Its use was widely taught. By using the alidade as a surveying level, information on the topography of the site can be directly recorded on the drawing as elevations. Distances to the objects can be measured directly, or by the use of stadia marks in the telescope of the alidade.

The stadia board was a level rod, usually about 10’ or 15’ tall, and usually 4” or 6” wide with very large letters. The stadia rod used by John and Jerry Sanford in this 90 acre farm survey, was a 4” wide x 10’ tall “E-Rod.” Each division on the E-Rod is 1/10th of a foot. There are black “E’s” on the lower 5’ of the rod, and red E’s on the upper 5’ of the rod. Some of the rods have a built in level on the back side to plumb the rod.

In the later part of the 20th century, the automatic compensating level was introduced, and was added to the alidade to speed up the leveling process. Oil and Gas companies and the U.S. Army Corps of Engineers used the plane table to map engineering project surveys and many military bases.

In the 1980’s the introduction of the Total Station with data collection turned the plane table and alidade into museum pieces.

In the past, Surveyors, like John Sanford have spent years bent over a plane table board. Surveyors using the plane table could not lean on the table, or bump the table because that would cause it not to be level.

Weather is also a large factor when using the plane table. When it is hot, the surveyor must be careful not to let sweat drip onto the drawing paper. When it is too cold, fingers can become stiff which makes drafting work difficult. When it is windy, that can also cause problems. Rain or drizzle will shut down plane table work. When the sun is overhead and bright, the reflection from the white paper can be problematic. Also, bending
over the plane table for hours each day can take a toll on the user’s back.

The contrast between using the alidade/plane table and modern electronic survey equipment is interesting. Here are some details of the 90 acre topographic survey performed by John Sanford and his brother, Jerry Sanford, age 70:

- The survey was done in six week time period, which included some inclement weather. Holding the 4” wide x 10’ tall stadia board plumb for eight hours per day in windy conditions was difficult. Weekends were not survey days for John and Jerry.
- The survey required 40 plane table set-ups, and there were 634 shots. Each of the 634 shots was recorded in a log book, which John carried in a special log book holder attached to his waist. With each new plane table set up, over a 2” x 2” wood hub, John would center the table over the hub, level the table, and using a corrected compass reading, rotate the table top to face true north. John would then take a back-sight on the previous hub. If the back-sight line and distance to the previous hub did not match the fore-sight line already drawn on the paper, John had to correct before proceeding.
- The maximum distance for most of the shots was about 400’ to 500’, though a few were made at 1,400 feet distance. The large letters on the “E-Rod” were necessary for the 1,400 foot shots.
- The plane table was always set up centered over the hub and faced true north.
- The drawing scale was 1”= 60 feet.
- The finished drawing size was 30” x 57” on Mylar drawing paper. The Mylar is much more durable than normal drawing paper, and works well with the plane table.
- The upper case printing and line work on the drawing was extremely neat and precise.
- A creek with 30’ steep banks crossed the farm. This added complexity to the survey and the drawing.
- Two (2) foot contour intervals were plotted.

Norman Sloan, PE, PLS, has been involved in surveying since 1962, and is currently a consultant to Quanta Pipeline Services in Tulsa, OK. He is licensed in OK, TX, KS, CO, & LA.