

Volume 23: Issue 2
April, 2012



LINES & POINTS

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News & Announcements
Important information about Virginia Earthquake!
SmartNet Team is working to determine the possible effects of the Virginia Earthquake on SmartNet stations → Full story

SmartNet North America User Portal officially launched!
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PLSW (Professional Land Surveyors of Wyoming) is a statewide organization of Registered Land Surveyors licensed to practice in the Equality State of Wyoming. PLSW is dedicated to improving the technical, legal, and business aspects of surveying in the State of Wyoming. PLSW is affiliated with the National Society of Professional Surveyors (NSPS) and the Western Federation of Professional Land Surveyors (WestFed).

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On The Cover

*S.W. Cornerstone of the
1870 GLO Survey of
Cheyenne as perpetuated.
(Photo By Jack Studley)*

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FAREWELL TO FELLOW SURVEYORS
Mike Mickiewicz & Joseph Surenant

2011 PLSW SUSTAINING MEMBERS

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- Cathy Fromma - Trimble
- Richard Monsen - Monsen Engineering
- Bryan Baker - Frontier Precision Inc.

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For more information please contact Pete Hutchison or Jack Studley.

PRESIDENT'S MESSAGE



Spring greetings to you all!

As we put winter to bed and start to see the new buds on the trees the warmer weather brings the start of our busiest season.

Since the last column we have made it through Wyoming Engineering Convention in Sheridan. Our attendance at the convention this year was strong, as the weather cooperated and made travel easy. For those that couldn't make it, we had two Special Guests attend the Annual Meeting. They were Kim Leavitt, P.L.S., National Society of Professional Surveyors (NSPS) Area 7 Director and Dr. David Whitman, P.E., President of the Wyoming State Board.

By the time this reaches all of you, National Surveyors Week will have passed and I hope everyone was able to celebrate it in some way.

The spring meetings for NSPS have been scheduled for May 4-6 in Charlotte, NC at the Charlotte Marriott Executive Park. The main topic will continue to be the restructuring of ACSM and NSPS. As of now, the merger is still not quite complete due to some legal issues. Those issues are just about worked out and I hope to report the next time that the restructuring is complete. A key result of the process is an anticipated drastic reduction in the amount of dues and hopes that we can get more surveyors to join. I will keep you posted as the process proceeds.

Well I guess that's all for now and I look forward to a warm and profitable Spring.

Respectfully,

Cotton D. Jones, President

Professional Land Surveyors of Wyoming

ANNOUNCEMENTS

- The Wyoming Board of Registration is now offering Professional Land Surveyor candidates the opportunity to take the 2-hour State Specific Examination on a given day each month during the year.

- The Bureau of Land Management respectfully requests that readers of the Manual of Surveying Instructions (2009) report any errors found. Email with the details to blmsurveymanual@blm.gov. For information and to view postings of reported errata visit the BLM Manual website at: www.blmsurveymanual.org.

- There are educational resources available at the NGS Online Learning Center with Online Modules, Presentations with Audio, and the Upcoming and Past Classes are at: www.ngs.noaa.gov/corbin/online_learning.shtml

- The NGS has announced that the CORS station WYSH has now been added to the national network. This station is in Sheridan, WY.

- The BLM has completed a project to scan approximately 25,000 pages of field notes that had been transcribed. These pages are from field notes of GLO surveys that are nearly illegible. Each page is posted on the Cadastral Survey website following the image of the original page.

- The 2012 Fall Technical Session speaker is Herbert Stoughton, Geodetic Engineer. He will be speaking on "Writing Legal Descriptions for Parcels and Easements", "Overview of Map Projections Used by Surveyors" and "Early History of Public Domain". We are looking forward to another great session.

- The date for 2013 Annual Meeting is 7 February 2013 at 2:00 p.m. at the Parkway Plaza in Casper, Wyoming.

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2012 ANNUAL MEETING

PROFESSIONAL LAND SURVEYORS OF WYOMING

Minutes Exerpts

2 February 2012

Location: Sheridan Holiday Inn, Sheridan, Wyoming

Number of Attendees: 47

President Jones introduced two (2) guests:

Kim Leavitt, NSPS Area 7 Director

Dr. David Whitman, Chairman of the Wyoming State Board of Registration

PLSW membership includes a total of 274 Members and Associates: 172 Members, 3 Life, 7 Honorary, 74 Associate, 6 Special, 6 Student and 6 Sustaining.

Treasurer's Report was unanimously approved:

Bank account balances as of 31 December 2011:

Checking Account	\$ 2,923.35
Savings Account	\$ 11,054.82
Investments	\$ 110,833.75
Total cash	\$ 124,811.92

2012 Budget was unanimously approved.

Treasurer Scherbel reported the main reason for being over budget was due to an adjustment he made to cover the \$5.00 per member annual contribution to the Scholarship Fund, which had not been made for the past 2-3 years. The adjustment was in the amount of \$4,750.

Committee Reports:

Audit - Finance: Kevin D. Jones, 2nd Past President, reported his audit found the organization's finances to be in good shape. He recommended having a standard procedure and checklist for doing the audit. Kevin and Marlowe will work to prepare an audit procedure.

History: Herb Stoughton, chairman, provided a verbal and written report. The Board of Directors should decide how to distribute the updated history. Possibly putting them on the website. Herb is currently microfilming and arranging to digitize all volumes of Lines & Points.

Investment Committee: Jon Anderson, chairman, provided a written report indicating the status of our investments. Jon recommended staying the course with no increase in equity position. Marlowe gave a verbal report. Kevin Jones asked about requirements for selling MFS Fund Stock, if PLSW ever wanted or needed to sell. Marlowe will talk to Paul N. Scherbel, who donated the stock, and report back at next Board of Directors meeting.

Legislative Committee: Mark Corbridge, chairman, gave a report concerning the proposed legislative changes to the statutes for Professional Land Surveyors. Dr. David Whitman also provided comments on the new legislation.

Lines & Points Committee: Jack Studley provided a Treasurer's report on the finances and success of the Lines & Points magazine.

Delegate Reports:

NSPS: The NSPS Area 7 Director, Kim Leavitt, gave a report

on the status of NSPS. Cotton Jones, NSPS Governor, reported that the merging of ACSM/NSPS is still in progress.

Western Federation of Professional Surveyors: Paul Reid, Delegate, gave a verbal report.

Old Business:

Kevin Jones, representing the Northwest Chapter, discussed the completion of the PLSW's CD project. President Jones indicated National Surveyor's Week is the third week of March each year.

Citations and Awards: President Cotton Jones

A Life Membership certificate presented to Lloyd Baker.

A Life Membership certificate for Paul N. Scherbel was accepted by his son, Marlowe.

The plagues will be forwarded to the new Life Members as soon as they are available.

Election Results: Jeff Jones, Teller

PLSW Officers for 2012 are Cotton Jones, President, Cevin Imus, Vice President and Marlowe Scherbel, Secretary/Treasurer. There were 96 eligible voters with 30 valid ballots received for all of the Officers. Each received 30 yes votes and 0 no votes.

By-Laws Amendments: The report from the Teller indicated that the By-laws amendments did not pass. There were 158 eligible voting members in 2011, with 66 votes cast and two (2) invalid ballots. This does not meet the By-laws minimum requirement of a two-thirds vote. Results:

By-laws change 'I' received 63-yes; 2-no; 1 votes abstain.

By-laws change 'II' had 64-yes; 2-no; and 0 votes abstain.

By-laws change 'III' had 61-yes; 5-no; and 0 votes abstain.

By-laws change 'IV' had 65-yes; 1-no; and 0 votes abstain.

By-laws change 'V' had 61-yes; 4-no; and 1 votes abstain.

Upon further review of the By-laws during the subsequent BOD meeting, the Board re-read "Article XIII AMENDMENTS Section 1. Implementation" which state:

"These By-Laws maybe altered, amended, or repealed, and new By-Laws be adopted by the affirmative vote of at least two-thirds of the Members, and Life Members of the corporation *voting*." (emphasis added).

The Board decided this statement clearly means two-thirds of those actually voting, not two-thirds of those eligible to vote. The earlier decision that two-thirds of the those eligible to vote was required to pass an amendment was in error. This means the By-Laws amendments actually passed.

Installation & Seating of 2012 PLSW Officers and President's Inaugural Address.

New Business:

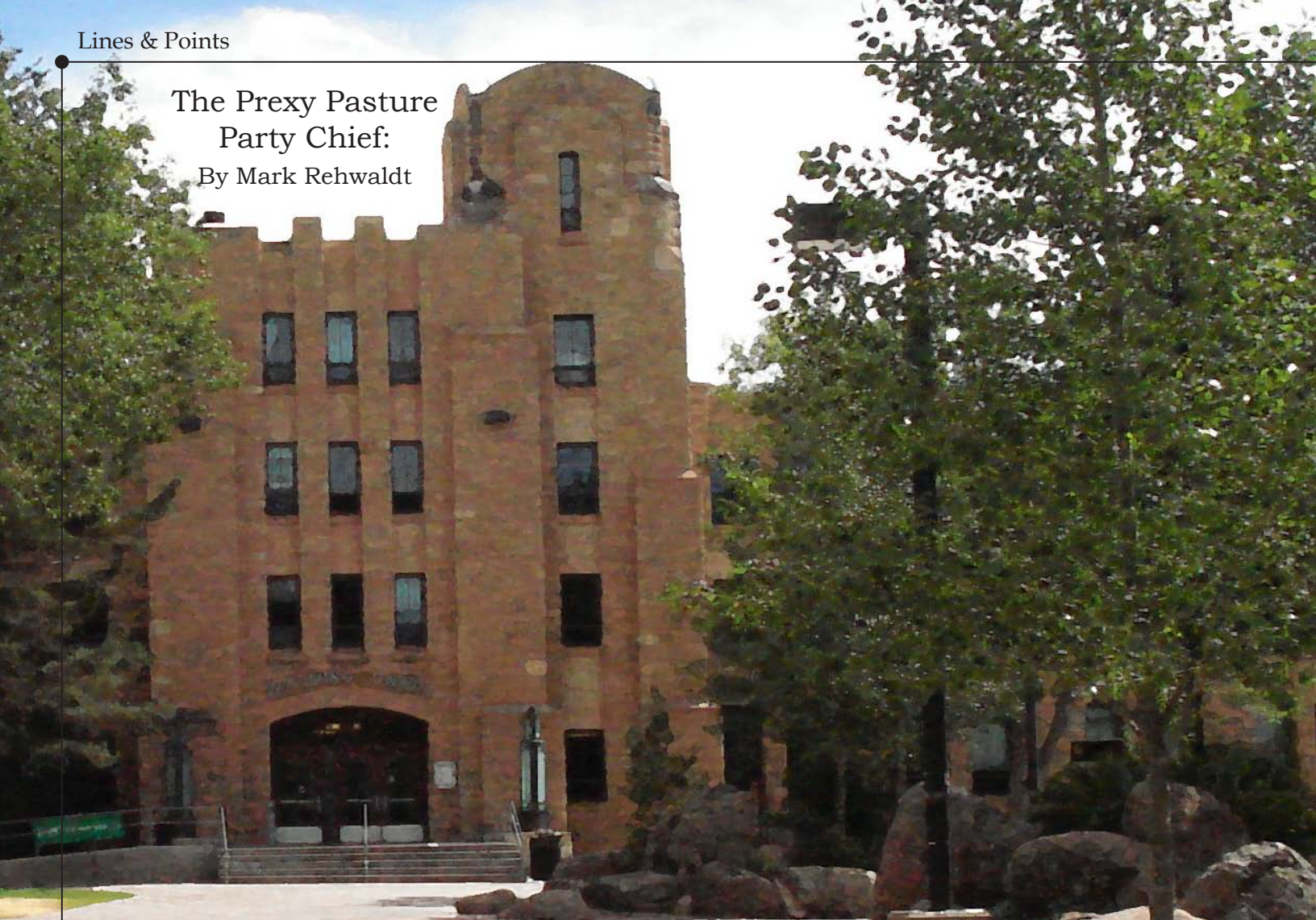
A motion to change the SOS award to: 1st Place: \$150.00; 2nd Place: \$100.00; 3rd Place: \$75.00 was moved to the Board of Directors meeting.

A motion to award Rick Hudson \$175.00 for the 2011 SOS contest was made by Paul Reid and seconded by Jeff Jones. The motion was unanimously approved. Rick was the only submittal.

The meeting adjourned at 3:50 pm.

The Prexy Pasture Party Chief:

By Mark Rehwaldt



While I am writing this, there is one week of classes before spring break. The surveying students are traversing Prexy's Pasture after digging through the snow and ice to find the traverse points. So far this winter they haven't missed a lab due to weather conditions although some of them come in after lab with pretty chilly hands, but no complaining. I am impressed with the student's attitudes.

- When I started in the fall of 2009, the College of Engineering and Applied Science and the Civil and Architectural Engineering Department generously agreed to provide financial support to the land surveying program. The support was given for a three year period to enable the program to become better established. The three years are coming to an end this semester and the land surveying program has requested a tuition increase to cover this revenue stream. I am not in favor of raising tuition in this economic climate, but not raising the tuition would probably end the land surveying program.

- The Wyoming Board of Registration for Professional Engineers and Professional Land Surveyors and I have discussed increasing the number of hours and defining the requirements of the Land Surveying Certificate to match the Board's surveying specific education requirements. We are progressing.

- During the WES Convention in Sheridan, the Land Surveying Program Advisory Board met. We focused on approving the bylaws and electing temporary officers. The next meeting of the Advisory Board is scheduled for the PLSW Fall Technical Session in Casper at the Ramkota. During that meeting I would like to have officers elected, Board members seated, and begin discussing what skill sets the surveying and mapping community would like to have in future employees. The Advisory Board Bylaws have charged PLSW with nominating Board members. This was not to create additional duties for PLSW, but to give the surveying community through PLSW as much voice as possible in the land surveying program.

Watch out spring break. Here we come. The students will be rip snorting, I have heard some nasty rumors that some of them will be going home to catch up on sleep. We old folks will probably be rip snorting also, staying up until at least 9:15 pm.

Minutes of the University of Wyoming Land Surveying Program Advisory Board

February 3, 2011

The meeting was held in conjunction with the 2012 Wyoming Engineering Society Meeting at the Holiday Inn in Sheridan, Wyoming. The meeting was called to order at 7:00 a.m. by Mark Rehwaldt, University of Wyoming Land Surveying Program Director.

Attendance:

Chris Asbury
Lloyd B. Baker
Ami Erickson
R. L. "Rick" Hudson
Lindy Johnson
John Lee
Mark Rehwaldt
Dick Schmidt
Herbert W. Stoughton

Bylaws - Stoughton moved to approve the University of Wyoming Land Surveying Program Advisory Board Bylaws as presented. Second: Hudson. No Discussion. Motion unanimously approved.

Secretary - Hudson nominated Rehwaldt for Board Secretary. Second: Stoughton. There were no further nominations. Stoughton moved that nominations be closed. Second: Asbury. Motion approved. A vote was called, Rehwaldt was unanimously elected as temporary Secretary.

Temporary President and Vice-President - Stoughton suggested that a temporary president and vice-president be elected. Hudson nominated Stoughton for president. Second: Erickson. Hudson moved that nominations be closed. Second: Lee. Motion approved. A vote was called and Stoughton was unanimously elected as temporary president.

Hudson nominated Asbury for vice-president. Second: Baker. Hudson moved that nominations be closed. Second: Baker. Motion approved. A vote was called and Asbury was unanimously elected as temporary vice-president.

Next Meeting - The next Land Surveying Advisory Board meeting was set for the Professional Land Surveyors Fall Technical Session which will be held at the Ramkota Hotel, in Casper, Wyoming on Friday, November 2, 2012.

Adjournment - Temporary president Stoughton adjourned the meeting at 7:55 a.m.

Computer Based Testing Update

The National Council of Examiners for Engineers and Surveyors (NCEES) has introduced an online information center explaining the latest developments as the FE and FS exams are moved to computer based testing. The transition is scheduled to be complete in January 2014.

Visitors to ncees.org/CBT can get the latest news and announcements. The site will also have answers to FAQs, such as how the exams will change and where and when they will be offered.

"Now is the time to focus on communicating with other groups, including engineering and surveying educators, so that everyone's ready when January 2014 arrives," said NCEES Executive Director Jerry Carter.

NCEES will present two CBT webinars this Spring season. The first is for members of the American Society of Engineering Educators explaining the latest developments in the transition and the effect on students and engineering programs. The second webinar is to be presented through Point of Beginning (POB) magazine on May 8th (2:00 EDT) to educate professional surveyors about the move to computer based testing.

Information on both of these webinars, including registration information, will be posted on ncees.org/CBT as it becomes available.

The new online information center and upcoming webinars are part of NCEES's overall communications strategy for the transition. "We want this move to go as smoothly as possible, so it's vital that we keep everyone updated on the latest activities and give them the resources to easily find the answers they need," said Carter.

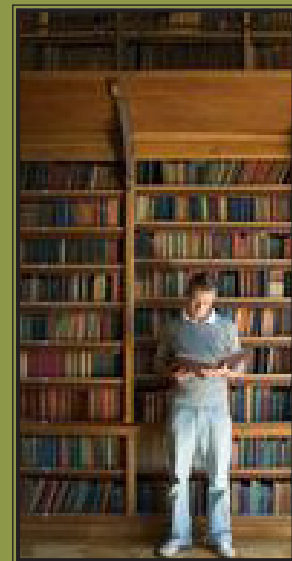
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ANOTHER TALE OF TWO CITIES – PART III

With a Cheyenne City truck parked along Talbot Ave. at the intersection of 30th, with the safety light bar flashing, the people in the neighborhood knew something was being worked on near the sidewalk. So they were keeping an eye on what was going on during the morning. Only three of the neighbors called the Mayor's Office to inquire who and why the City employee in the orange safety vest was dancing in the street.

Just kidding!! I didn't really dance in the street, and no calls were made to the Mayor's Office. But in my heart and mind I most certainly was dancing. Research for the original position of the northwesterly corner of the General Land Office (GLO) townsite survey of 1870 had mostly indicated that this stone was gone and been replaced with metallic monuments. In fact, a modern day No.5 rebar with an 1 ½" aluminum survey cap was found in the immediate area. But measurements in the area kept coming up with discrepancies, which the area was well known for. And I just had a gut feeling that I wanted to do more digging around the area to see if the stone might still exist.

The yards for these rental homes were not well kept, and when I called the respective land owners to tell them what I was doing, they granted permission to dig up their respective yards in my search. I referenced the found survey cap and excavated a 2' x 3' area x 18" deep on the northerly side of the found monument, to no avail. I found a couple of fence post remnants, but no stone or stone remnants.

I then started excavating south of the found survey cap, which was only about 3' off the sidewalk. Very quickly I heard that wonderful clinking sound when hitting a buried stone, and in my mind I started to dance. The stone was found only five inches below the surface. Nicely chiseled on the southerly face of the stone was "NW". The GLO notes described the stone as "Set Stone 32 x 9 x 4 in mound for NW Cor. (Red Sand Stone)".

I then backfilled the northerly excavated area, and further excavated around the found stone for the purpose of setting a brass cap atop the stone as a memorial, and encasing it in a 12" diameter cast iron street monument box, for easy access in the future.

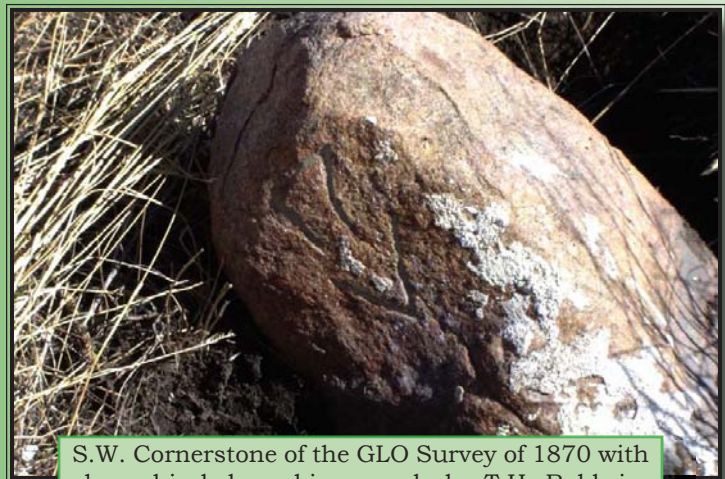
All local Professional Land Surveyors with monuments found in the area were notified of this find, and a Wyoming Corner Recordation form was prepared and filed in the Laramie County Clerk's Office.



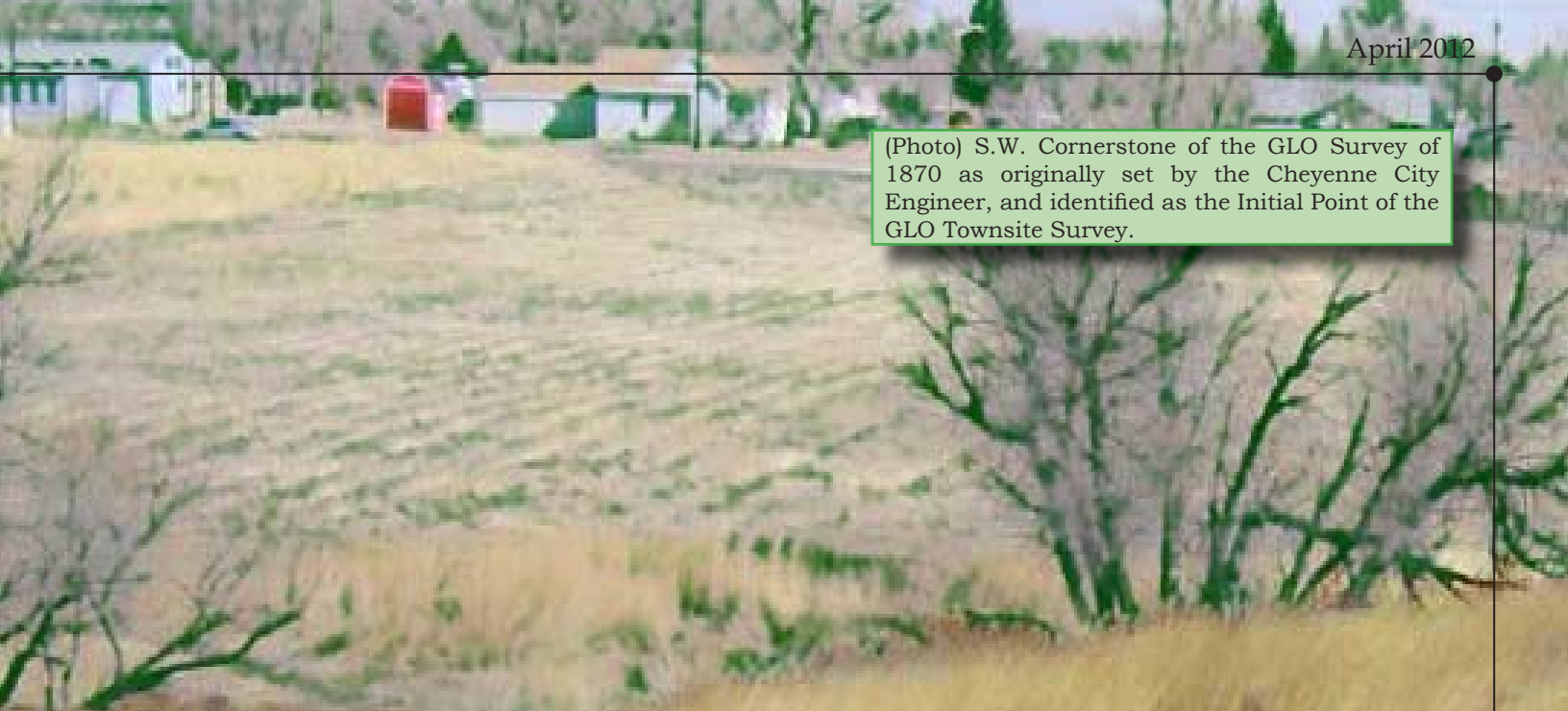
Areas of excavation in the vicinity of the N.W. Corner of the GLO Survey of 1870.



N.W. Cornerstone found one foot off the sidewalk, clearly marked with chiseled "NW"



S.W. Cornerstone of the GLO Survey of 1870 with clear chiseled markings made by T.H. Baldwin, PE&LS No. 19 as a part of the boundary survey of Interior Heights in 1917



(Photo) S.W. Cornerstone of the GLO Survey of 1870 as originally set by the Cheyenne City Engineer, and identified as the Initial Point of the GLO Townsite Survey.

Next, we have the southwesterly corner of the GLO townsite survey of 1870. This stone monument is actually the initial point of the survey, and was found on the surface, tilted to the northeast. I found only passing reference to this stone in modern day surveys, but the references were to "unknown origin" or "unidentified". Part of the reasoning for this was that the GLO notes do not describe this stone corner monument, so nobody knew exactly what size, shape or type of stone this corner ought to be. The reason for this was that this stone monument was set in place by the City Engineer in 1870 and was requested to be the starting point in the application for the Townsite Survey. The GLO notes only state "Beginning at Stone Mound Corner". I have not found City Engineer's Office notes describing this corner stone.

The found stone had very unique chisel markings that needed to be identified and described. On the westerly face of the stone we have the number "17" with a "V" under it, and on the easterly face the letter "B". Speaking with Jeff Jones, PLS, he informed me that T.H. Baldwin, PE&LS, early Laramie County Surveyor, often times marked his corner stones with a "B" to identify them as having been set by him. So I researched the Baldwin field survey books in the Laramie County archives and found in Book II, page 83, dated May 22, 1917, the traverse diagram of a boundary survey conducted for R.S. VanTassle of Interior Heights Cheyenne. This plat boundary is inclusive of the southwesterly corner of the GLO Townsite Survey, which T.H. Baldwin had labeled as corner "17" on the diagram. My deduction being that the "V" is the symbol he used for the term "corner".

In Book 512, page 16 of the Cheyenne City Engineer's Field Books, dated 11/3/1937 I found a survey tie from Roberts Addition (1889) to the "S.W. Cor. Govt.". These notes described "The Cor. Is a stone in Fence Cor.". Remnants of ancient fence lines were found in both the easterly and northerly directions, as shown in the field notes, confirming this site as a fence corner. Further survey ties to found monuments in the Roberts Addition (1889) matched within

0.3' when the stone was placed upright. And fell within 0.2' of being on line with modern plat lines to the north.

I took other river rock type stones found in the area, which are not typical of the area, and placed them around the stone placed upright. It is intended to further preserve this site with a concrete pad poured around the stones and placement of a descriptive historical sign.

So far we have covered the four found stones on the westerly lines of the GLO Townsite Survey of 1870 (2) and the Bond Resurvey of 1890 (2). I will now start to talk about the easterly lines of these two surveys, all the original corners of which are unfound and required reestablishment by survey ties to historic found monumentation in the immediate areas.



The northeasterly corner of the Bond Survey of 1890 is our anchor point for the reestablishment of this easterly side of the Cheyenne City boundaries. Primarily because it has the best available evidence and tightest survey ties for relocation.

"She is just a silly old lady!!" is what was heard from some of the neighbors when asked about how Helen P. Davis would post a sign in her front yard each year during Frontier Days, reciting "NE corner of Cheyenne". But as it turns out, Ms. Davis knew her history and the specific



N.E. Corner of the BOND Survey of 1890, reset from found subdivision corners in the immediate area.

history around her home of so many years (at least 58, she passed away in 2010) at 1510 Andover Drive. For the original Bond Survey Stone of 1890, at the NE corner of Cheyenne City, was located just off the southeast corner of her property at Lot 29, Block 12, Eastridge 3rd Filing, in the Andover Drive right of way.

The second was in March 1951 from multiple corners in Block 12, Eastridge 3rd Filing, which was approved in Aug. 1950. Two of the original survey monuments along the westerly right of way of Andover Drive were found 18" to 24" below the current ground surface, thus preserving these monuments. One at the "PC" in the front of Lot 28, and the second at the SE

corner of Lot 31, Block 12. Using these two corner monuments and the survey ties in Book 613, the Bond Survey stone position was measured to a point on the sidewalk, almost directly in line with the lot line between Lots 29 and 30. This position fell within 0.18' of the computed position from the first, Colonial Addition tie. This tied position is considered to be a very reliable representation of the original position of the Bond Survey stone of 1890.

You will note that the brass cap falls on a concrete sidewalk joint with the section to the right being narrower than a standard sidewalk segment. Well this tweaked my curiosity a little bit, and being a good public servant I "CALLED BEFORE DIGGING" and requested a utility locate for the site. And low and behold a gas pipeline locate was painted right across this narrow slab for the service line going into the residence. I removed the concrete section of old sidewalk and very carefully dug approximately 18" deep and found nothing. I then proceeded to drive a No. 4 rebar very slowly into the ground approximately 3' to see if I hit a large stone as described in the Bond Survey, but again nothing. And fortunately for me, I didn't find a gas pipeline either. I

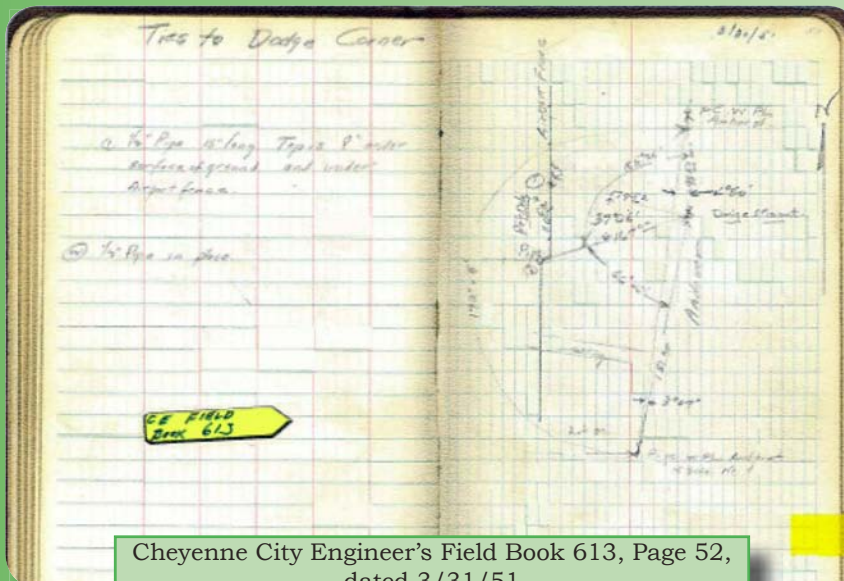
speculate that perhaps the original Bond Stone was removed during placement of the gas line by an equipment operator who didn't have a clue as to what the stone may represent, it was simply an obstacle.

I then re-poured the sidewalk and the position is now remonumented with a 3" diameter survey brass cap, set flush with the surface, per the survey ties of record.



immediate area. Note that the field notes refer to this corner as the "Dodge Corner", inferring that the Bond stones were considered to be a retracement of the Dodge Survey.

The first survey tie was in August 1949, from the northeasterly corner of Block 2, Colonial Addition, approved in July 1947. The original Colonial Addition corner monument used to tie to the Bond Stone was not found. So, other monumentation in close proximity



Cheyenne City Engineer's Field Book 613, Page 52, dated 3/31/51

(Photo) S.W. Cornerstone of the GLO Survey of 1870 as perpetuated. Looking eastward you can see ancient fence remnants supporting this position as described in the old field books.

We will conclude this project in the next issue of LINES & POINTS.

Application of the Quadratic Formula to Surveying Problems

Herbert W. Stoughton, Ph.D., P.E., P.L.S., C.P.

Geodetic Engineer

Introduction

In high school in the 1950's and 1960's, every student contemplating attending post secondary academic institutions faced the requirements of successfully completing four years of English/writing/rhetoric, social studies/geography/history, physical education; a minimum of three years of mathematics, general science/life science/chemistry/physics; and a variety of electives mandated by the state education department.

The second course in algebra, then called intermediate algebra, combined the concepts of elementary algebra with deductive reasoning developed in plane geometry for developing equations and formulas which described scientific phenomena.

One of the concepts introduced is quadratic equation or quadratic formula. The problem statement is to develop a formula for the direct solution of a second-order equation in one unknown having the form:

$$ax^2 + bx + c = 0$$

Where x is the unknown variable, and a, b, c are real numbers (positive, negative, or zero), called coefficients. If a equals zero, $x = -c/b$. If b equals zero, $x^2 = -c/a$. If the numerical values of a and c are both positive, then x is imaginary, or $x = c/a \cdot i$. If c equals zero, then $x = 0$, or $x = -b/a$. When a, b , and c are nonzero, then the solution requires additional effort to solve for the quantity x . At this point of the course, the concept of "completing the square" is introduced. After suitable algebraic manipulation, the quantity x can be solved directly with a 'closed formula'.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The quantity $b^2 - 4ac$, when the numerical values of the quantities a, b , and c are inserted, immediately identify whether the roots are real or imaginary.

It is at this point that "the teaching ball is dropped",

because the mathematics teacher usually fails to reinforce the concepts presented. Reinforcement is not just providing problems with integer values for the coefficients and solving for the unknown, x , but is to demonstrate real world applications.

The remainder of this paper will illustrate two applications in surveying and mapping utilizing the quadratic formula.

Missing Elements of a Polygon

Elementary surveying textbooks address the problem of missing two dimensions of the perimeter of a plane polygon. The author's approach is convoluted, and difficult to comprehend. The problem simply stated, is that two dimensions (two bearings, two distances, or one bearing and one distance) have been omitted. The first step is to convert all the bearings to azimuths for all lines (sides) having both the azimuth and distance given, (n-2) lines [Note: there is a special case when the unknown azimuth and distance are on the same line; then there are (n-1) lines.]. For a polygon of n sides, the following are calculated [sum of the latitudes and departures]:

$$A = \sum s_i \sin \alpha_i$$

$$B = \sum s_i \cos \alpha_i$$

If the sides with a unknown element are identified as "1" and "2". then the condition equations for this problem are:

$$s_1 \cos \alpha_1 + s_2 \cos \alpha_2 + B = 0$$

$$s_1 \sin \alpha_1 + s_2 \sin \alpha_2 + A = 0$$

If two sides are unknown, the solution for the distances s_1 and s_2 are *not* quadratic equations.

When one distance (s_1) and one azimuth (α_2) are unknown, let:

$$v = \tan \alpha_2$$

$$U = \frac{Bs \sin \alpha_1 - A \cos \alpha_1}{s_2 \cos \alpha_1}$$

After several algebraic manipulations and trigonometric substitutions:

$$[1 + v^2]\cos^2\alpha_2 + 2Uv\cos\alpha_2 + [U^2 - 1] = 0$$

This is a quadratic equation having $\cos\alpha_2$ being the unknown. Then, after applying the quadratic formula and simplifying:

$$\cos\alpha_2 = \frac{-U \pm v^2 + 1 - U^2}{(1 + v^2)}$$

For each value of $\cos\alpha_2$ there are *two* values of α_2 (between 0° and 360°)

Now, let:

$$U = A^2 + B^2 - s_2^2$$

$$V = A\sin\alpha_1 + B\cos\alpha_1$$

The resulting equation is:

$$s_1^2 + 2Vs_1 + U = 0$$

This is also a quadratic equation. Then, its solution is:

$$s_1 = -V \pm \sqrt{V^2 - U}$$

There will be two solutions for s_1 .

By substituting each of the values of α_2 and s_1 into the original condition equations, only *one* combination of the values will simultaneously equal zero for *both* conditions.

When two azimuths are unknown, let:

$$U = \frac{1}{2As_2}(A^2 + B^2 - s_1^2 + s_2^2)$$

After suitable algebraic manipulation, the following quadratic equation results:

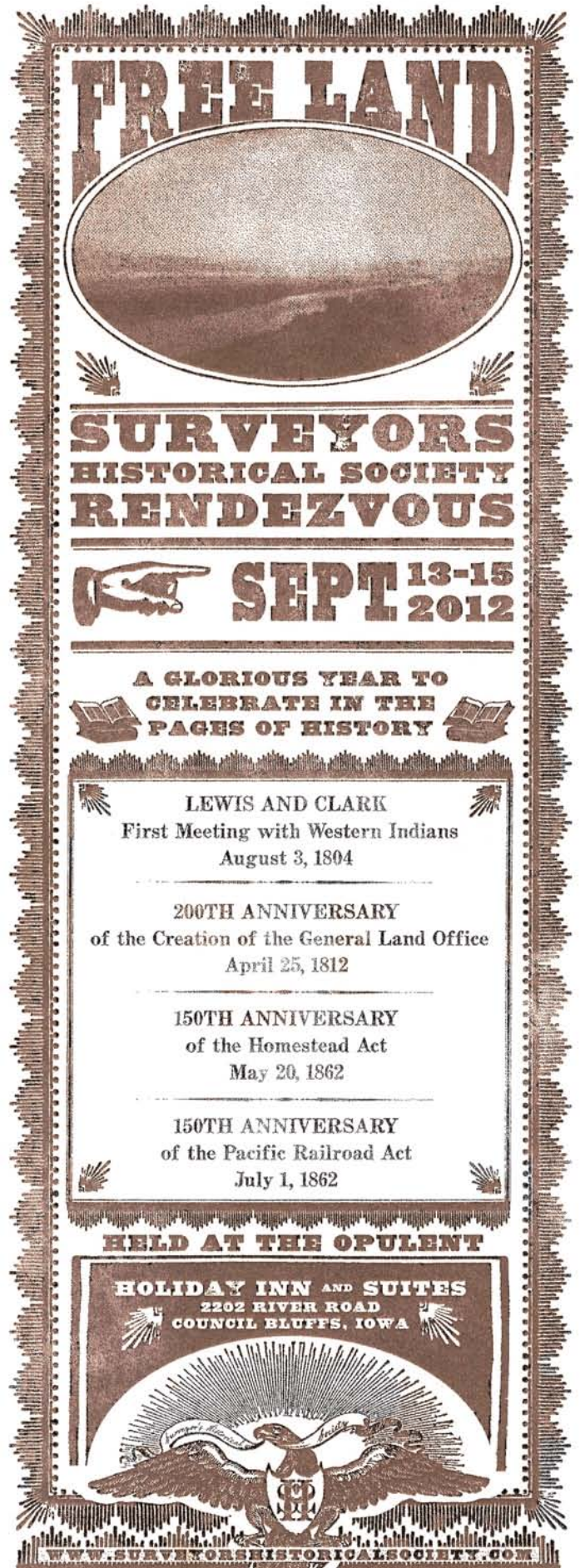
$$\frac{A^2 + B^2}{A^2}\cos^2\alpha_2 + \frac{2BU}{A}\cos\alpha_2 + (U^2 - 1) = 0$$

Then, the solution is:

$$\cos\alpha_2 = \frac{-BU \pm A^2 + B^2 - A^2U^2}{\frac{B^2 + A^2}{A}}$$

Then, let:

$$U = \frac{1}{2As_2}(A^2 + B^2 - s_1^2 + s_2^2)$$



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After suitable algebraic manipulations, the following quadratic equation results:

$$\frac{A^2 + B^2}{A^2} \cos^2 \alpha_1 + \frac{2BU}{A} \cos \alpha_1 + (U^2 - 1) = 0$$

Then, the solution is:

$$\cos \alpha_1 = \frac{-BU \pm \sqrt{B^2 + A^2 - A^2 U^2}}{B^2 + A^2}$$

There are four values each for α_1 and α_2 , which result in 16 combinations. Only one pair of values will simultaneously solve both condition equations.

Note: When determining which of the multiple values in the distance-bearing and bearing-bearing unknown elements problems, there will be instances when one condition equation will equal zero, but the second condition equation will not equal zero. Therefore, both condition equations must be computed to ascertain the solution.

Readers desiring to study the complete development, with numerical examples, are referred to: "Computing the Missing Elements of a Polygon"; by H.W. Stoughton; *Surveying and Mapping*; V. 35, No.3; September 1975; pp. 217-222.

Federal Elevations Near the Great Lakes

Prior to adoption of NAVD88, there existed two federal vertical datums in the Great Lakes region. Therefore, every bench mark had heights in both systems. In some instances, the bench marks had heights in one system, but required the height in the second system in order to complete the project. The numerical values were nearly equal. The orthometric elevation referred to the National Geodetic Vertical Datum of 1929 (NGVD29) [previously identified as MSL29]. The dynamic number referred to the Great Lakes Datum of 1955 (IGLD55).

Let h be the orthometric elevation (height) of a bench mark, and H be the associated dynamic number. Let ϕ be the latitude of the bench mark. Then, the relationship between h and H is:

$$H = h - (\alpha \cos 2\phi - \beta \cos^2 2\phi)h - \frac{k'}{2} (1 + \gamma \cos 2\phi - \frac{2}{3} ch)$$

The adopted values of the various coefficient for NAVD29 -IGLD55 are:

$$\alpha = 0.002644$$

$$\beta = 0.000007$$

$$k' = 0.0000\ 0031\ 47$$

$$\gamma = 00071$$

$$ch = 0.0000\ 0000\ 23$$

The expression $-(\alpha \cos 2\varphi - \beta \cos^2 2\varphi)$ is the *dynamic correction for latitude*, and the coefficient of h^2 is the *dynamic correction for elevation*.

Then:

$$H = h - D_1 h - d_2 h^2$$

Or:

$$H = -D_2 h^2 + (1 - D_1)h$$

The normal procedure is that the orthometric elevation is computed from field observations. The reason for this approach is that observations and orthometric elevations are in linear units. It was standard practice of the U.S. Lake Survey (USLS) to publish the dynamic number for a bench mark. However, surveyors working at

sites adjacent to the Great Lakes were frequently required to publish elevation data in both systems to satisfy numerous regulatory and permitting organizations.

The quadratic equation is:

$$D_2 h^2 - (1 - D_1)h + H = 0$$

Then, the orthometric elevation is:

$$h = \frac{-(1 - D_1) \pm (1 - D_1)^2 - 4 D_2 H}{2 D_2}$$

Note: The calculation of D_1 and D_2 must be carried to seven or eight significant figures.

A numerical example will illustrate the problem.

$$\varphi = 43^\circ 27.8' \text{ and } H = 76.405.$$

$$\text{Then, } D_1 = +0.0001\ 4173\ 5.$$

$$\text{and } D_2 = +1.5735\ 599 \times 10^{-7}.$$

$$\text{Then, } h = 76.417 \text{ meters.}$$

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ASPRS Honors

Dr. Herbert W. Stoughton

On Thursday, 22 March, the American Society of Photogrammetry and Remote Sensing (ASPRS) conferred on Ms. Karl J. Craun, Director of the U.S. Geological Survey, and Dr. Herbert W. Stoughton, Geodetic Engineer, the ASPRS Fellow Award. This is the second highest award for a member of ASPRS. The designation of Fellow is conferred on active Society members who have performed exceptional service in advancing the science and use of mapping sciences (photogrammetry, remote sensing, surveying, geographic information systems, and related disciplines). The designation of Fellow is awarded for professional excellence and for service to the Society. Candidates are nominated by other active members, recommended to the Fellows Committee, and elected by the ASPRS Board of Directors 2011 meeting). The nominees must have made outstanding contributions in a recognized Society specialization whether in practice, research, development, administration, or education in the mapping sciences.

For the past five decades Herbert Warren Stoughton has been a teacher, consultant, and expert witness in numerous matters relating to the use and application of photogrammetric generated data. Stoughton earned his B.S.E. (Civil Engr.), M.S.E. (Geodetic Engr.) and Ph.D. (Civil Engr.) degrees at the University of Michigan under the guidance of Professor Ralph Moore Berry, who had been a photogrammetric and geodetic engineer at the U.S. Coast and Geodetic Survey from the 1930's to the 1950's. During the summers of his undergraduate years, Dr. Stoughton learned the topographic mapping procedures necessary to support photogrammetric mapping at the U.S. Geological Survey. This field experience and the knowledge gained would be invaluable in Dr. Stoughton's career.

After earning his baccalaureate degree, Dr. Stoughton worked on photogrammetric mapping projects with O'Brien, Gere & Quinn (Syracuse, NY) and the large municipal utility - the Metropolitan Water District of Southern California (MWD of SC). This latter assignment introduced Stoughton to all the aspects of contract monitoring and contract quality control assessment for surveying and mapping products.

In 1969, Stoughton returned to the University of Michigan for graduate studies. He completed two photogrammetric studies in cooperation with graduate students in the College of Dentistry employing photogrammetric principles to study dental issues. Stoughton wrote the analytical photogrammetric computer programs and tutored the graduate students in how to reduce and evaluate the numerical results for their investigations.

Dr. Stoughton taught surveying at the SUNY New York at Alfred Ag. & Tech. He taught himself how to setup and maintain stereoplotters. The institution had five stereoplotters designed and built by four different organizations, including an experimental prototype from the U.S. Army Topographic Command. He constructed a photogrammetry teaching laboratory for the stereo-plotters and a mono-comparator. His only sources of information were a series of photographs (including the ASP Manual of Photogrammetry). His work and credentials earned him the ASP Certified Photogrammetrist (No. 302).

In 1980, Dr. Stoughton joined the Defense Mapping Agency Geodetic Survey Squadron where he was called upon to evaluate photogrammetric products to support DoD weapon systems geodetic requirements. His first assignment, as a project manager, was to develop a field survey program to support the calibration of the SR-71 on-board photographic sensor hardware. His procedure reduced the estimated manpower requirement from one man year to less than one man month. For his effort, Dr. Stoughton received a letter of commendation from the Director of the DMAAC. Stoughton introduced multi-quadric interpolation which was used to estimate (interpolate) values of gravity, deflections of the vertical, point datum transformations, contouring, and co-location using irregularly spaced data. At the time, Dr. Stoughton wrote and published a monogram for surveyors on the principles of photoidentification and paneling for photogrammetric mapping. For several years, he has presented a seminar on the role of the land surveyor in photogrammetric mapping, which addresses the issues of writing technical contract specifications and assessment of acceptability of photogrammetric mapping products. Stoughton presents the list of contractual elements necessary to address the project and evaluate the resulting project. Also, the seminar addresses the issues of quality control, litigation, negotiation, and arbitration.

Since the late 1980's, Dr. Stoughton has been a subject matter expert in litigation about mapping and photogrammetric products. His knowledge about the history of topographic and photogrammetric mapping has been sought by attorneys involved in complex litigation. For the past several years, Dr. Stoughton has served on the screening/evaluation committee for the ASPRS mapping scientist certification.

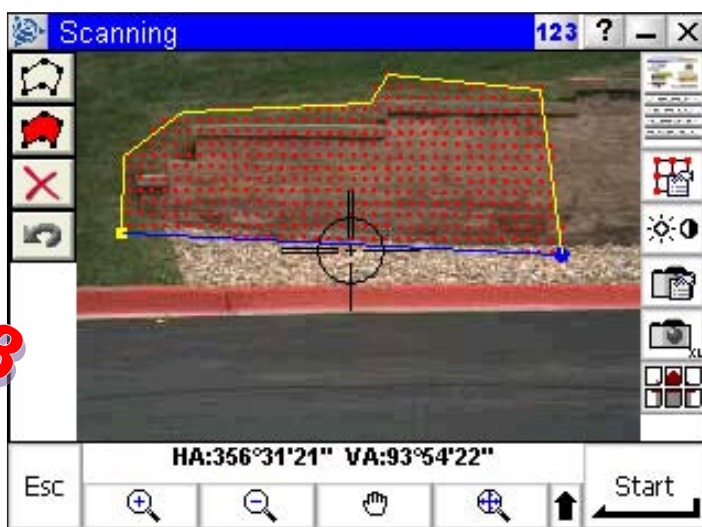
Also, Dr. Stoughton is a Fellow of the American Congress on Surveying and Mapping and Honorary Member of the Professional Land Surveyors of Colorado. Herb and his wife, Catherine reside in Cheyenne, Wyoming.



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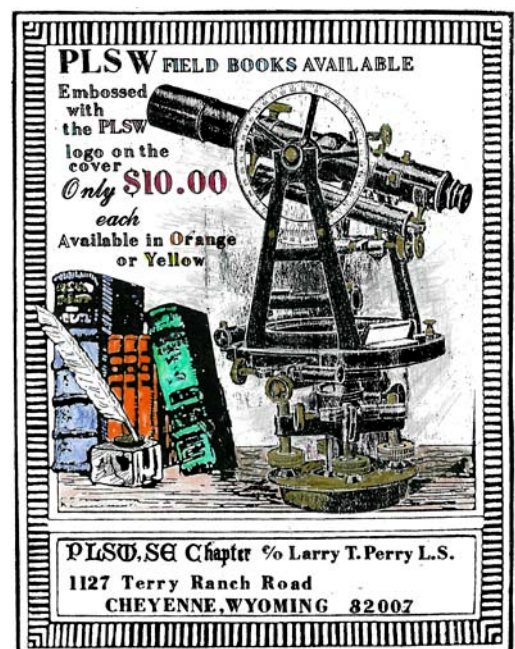
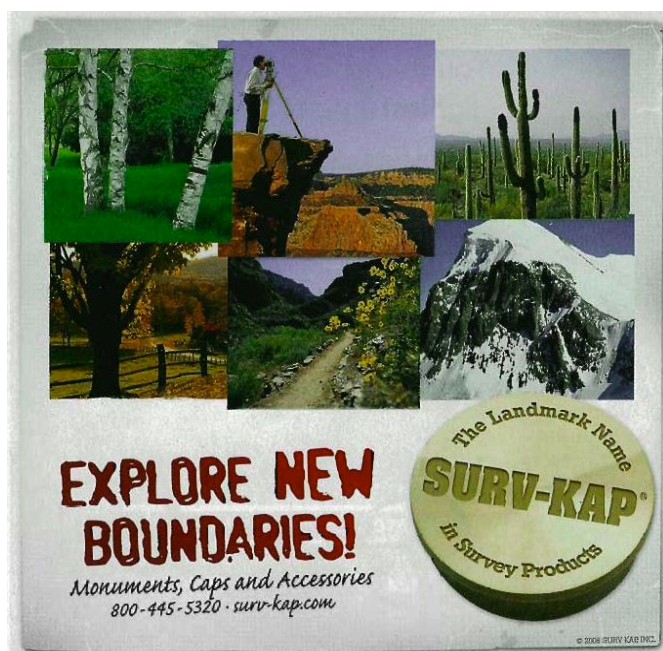
Mike Mickiewicz

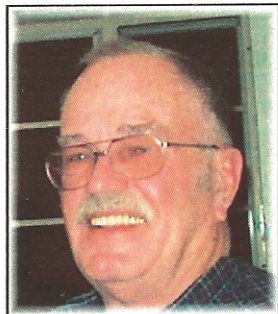
This is a remembrance of a friend.. We all pass through this world and should we by good fortune find a friend, we have been blessed. I can't see my friend Mike sitting down with the prophet Ezekial or much less the apostle John, discussing surveyor issues in the next world. I can imagine him sitting down at a table where David Thompson, Abe Lincoln and even George Washington are discussing a survey problem from here on earth. He would walk up and take that empty seat at the table and listen. After a while, he would inject into the conversation: "I had this one over in Bremerton.."

Washington state will miss this one, as will those of us in the Western Federation of Professional Surveyors. The upcoming conference in Washington will be less for the absence of Mike. I met Mike through my assignment to the board for WESTFED, a few years back now. Surveying was his life, his passion and he would share any survey experience or knowledge in his library, all you had to do was ask. Through Mike, I have met a lot of you across the west. We in WESTFED will miss our friend, for his smile, ready wit, huge presence and most of all for his friendship. The 'winding down' at the end of the day will not be the same, without him. There are few people in this world that can brighten a day, Mike was one of those few. He took the time to share a few special places with me. You in the survey world know about this, that place that you went to find that corner and came away with a special awareness of the beauty of nature, something you cannot easily describe. East of Seattle, out there in the forest, by a small river is a tree, "my tree" that came to my attention, through my friend Mike. I also had the special privilege to go "home" with Mike, out on Whidbey Island where he grew up.

We all must "pass" in this life and for those special persons, it happens all too soon, as is the case with Mike. We will miss him, we treasure the memories and suffer the heartache. But our comfort is in the knowing that we will see him in the next life, for we all are cutting brush and running line on that trail. Mike Mickiewicz, brother, friend, husband and father, a surveyor; is not this the best remembrance?

Harold Baldwin, Chair
Western Federation of Professional Surveyors
Chambers, AZ





In Loving Memory

Joseph A. Surprenant

ENTERED INTO LIFE

September 4, 1937

ENTERED INTO REST

February 8, 2012

Joseph Alexis Suprenant, 74, of Nunn, Colorado passed away 8 February 2012 at Hospice of Northern Colorado in Greeley.

He was born 4 September 1937 in Detroit, Michigan to Hilaire Suprenant and Marie (Hillaert) Suprenant. His family lived in Illinois, Indiana and West Texas before settling down in the Denver area. He graduated from Sheridan High School in 1955. He married Claudia Shaull in Loveland Colorado in 1966. Joe was as a Professional Land Surveyor in Colorado. He was employed by Colorado Highway Department (CDOT) for over 30 years.

While working at CDOT, he was instrumental in getting CDOT, WYDOT, the Colorado and Wyoming State offices of the BLM, the Washington Office of the BLM, National Park Service, National Geodetic Survey, PLSC and PLSW together to remonument the 71st and 72nd Mile Posts on the Colorado-Wyoming State Line in the fall of 1992. They also established the R/W on the East and West sides for US 287 on the State line South of Laramie.

Then in the Spring of 1998, he repeated this task on a grander scale. Again with a contingent from the BLM Colorado State Office, the BLM Wyoming State Office, CDOT members, WYDOT members, one member of the USC&GS (retired), members of PLSC and PLSW arrived at Interstate 25 to remonument the State Line at this location, Mile Posts 44 and 45 were remonumented and 44+54.35 and 44+59.83 , being the R/W monuments for Interstate 25 on the State Line. Then the same list of Surveyors proceeded to Greeley Highway (US 85) and remonumented the 37 and 38th Mile Posts and 37+34.49 and 37+59.01 being R/W monuments for Greeley Highway (US 85) on the Colorado~Wyoming State line.

After retiring from CDOT, he was in private practice as a Land Surveyor in Nunn, Colorado. He served on the Nunn, Colorado, telephone company board for several years. He enjoyed collecting coins, auctions, trains and skiing. He loved spending time with his family and friends and trips to the mountains. He will be remembered as having a helping hand and a smile for all.

Joe is survived by his son, John, brother, Thomas Suprenant, sisters, Helen O'Donnell, Lorraine Becker, Brother in Law, David Shaull, Aunt in Law: Dorothy Shaull, numerous nieces and nephews and grand nieces and grand nephews. He was preceded in death by his wife, his son Mathew and his parents.



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