

Volume 22: Issue 4
October, 2011



LINES & POINTS

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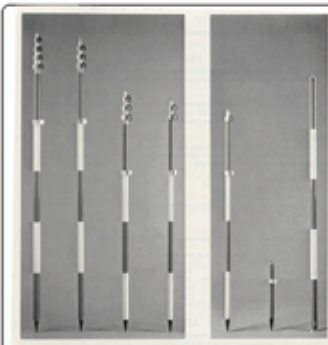


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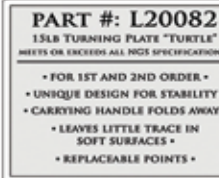


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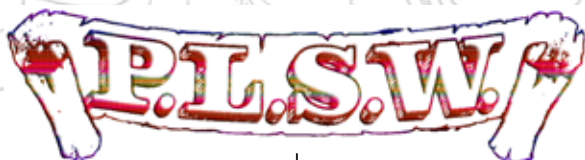


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On The Cover

From T-2 and 3800 to Total Station to GPS/GNSS Receivers.

(Photo By R.L. "Rick" Hudson, L.S.)

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PROPOSED CHANGES TO PLSW BY-LAWS

2011 PLSW SUSTAINING MEMBERS

- John Baffert - Surv-KAP, LLC
- Cathy Fromma - Trimble
- Richard Monsen - Monsen Engineering
- Bryan Baker - Frontier Precision Inc.

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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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Special Rates apply for PLSW Chapters and cover placements.

For more information please contact Pete Hutchison or Jack Studley.

PRESIDENT'S MESSAGE



Greetings to you all,

As our summer comes to a close and we head into fall I hope everyone had a busy and safe summer season. I know the workload around here is still backed up but starting to get a handle on it.

Since my last message I attended the ACSM/NSPS Summer meetings in San Diego. The big topic surrounding this meeting was whether ACSM would disband or not. During the Governor's meeting, the vote was almost unanimous for ACSM to be dissolved and NSPS to acquire all assets and liabilities from them. The vote was similar by the Board of Directors and the Congress vote 4 -2 to dissolve ACSM. The surveyors and geodesists vote for the motion with GLIS voting against. So now the reorganization committee is working diligently to dissolve ACSM and the member organizations to create one national organization in a effort to make it more attractive to those of us in the surveying and mapping fields. Also during the Governor's meeting Curt Sumner presented the awards for several categories including the NSPS 2011 Excellence in Professional Journalism in the State Society Newsletter Category which I accepted on behalf of our Lines & Points staff. Once again, thanks for an outstanding job guys!

The fall meetings will be held December 4-5 in Gaithersburg, MD for NSPS and AAGS the GLIS folks chose not to take part at this time. Lobby Day will take place on the 3rd prior to the meetings.

Our next Board of Directors meet will be at the Fall Technical Session in Casper, November 4 following the seminar. Please contact your Directors with any topics, comments, questions and/or concerns so they can be placed on the agenda.

That's all I have for now, I hope to see everyone at Fall Tech.

Respectfully,

Cotton D. Jones, President

Professional Land Surveyors of Wyoming

ANNOUNCEMENTS/MISC.

- 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 University of Wyoming Land Surveying program is assembling an Advisory Board, and is looking for volunteer Board members. Interested parties should contact Mark Rehwaldt at (307) 766-1700.

- 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.

- Check out the educational resources available at the NGS Online Learning Center with Online Modules, Presentations with Audio, and the Upcoming and Past Classes 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.

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PLSW: Board of Directors
Conference Call
27 August 2011

- Minutes from the 7 May 2011 Board meeting and the treasurer's report were approved.

- President's Report: Cotton Jones reported that he had accepted the first place award for State Society Newsletter at the ACSM/NSPS Conference in San Diego in July. The award will be presented to the Lines and Points Committee at the Fall Technical Session.

- Secretary's Report: PLSW membership has remained about the same as the last few years. We currently have 220 paid members.

Treasurer's Report:

Checking Account:	\$	833.00
Money Market Account:	\$	1,052.27
Investments:	\$	121,841.23

Committee Reports:

- Convention - WES convention will be in Sheridan on 2 & 3 February 2012. The Northeast Chapter will line up speakers for the surveyors program.

- Education - The Fall Technical Session will be held at the Ramkota Best Western in Casper on November 3-4. The speaker will be Mark Schenewerk. The subject will be: New Developments in OPUS, Models Used in GNSS Processing and Real Time Networks

- Scholarship - A \$1,000 scholarship was approved for Nate Stroud.

- Trig-Star - Winner of the 2011 Wyoming Trig-Star was Katelyn Gonterman from Big Piney High School and the teacher was Jennifer Banks.

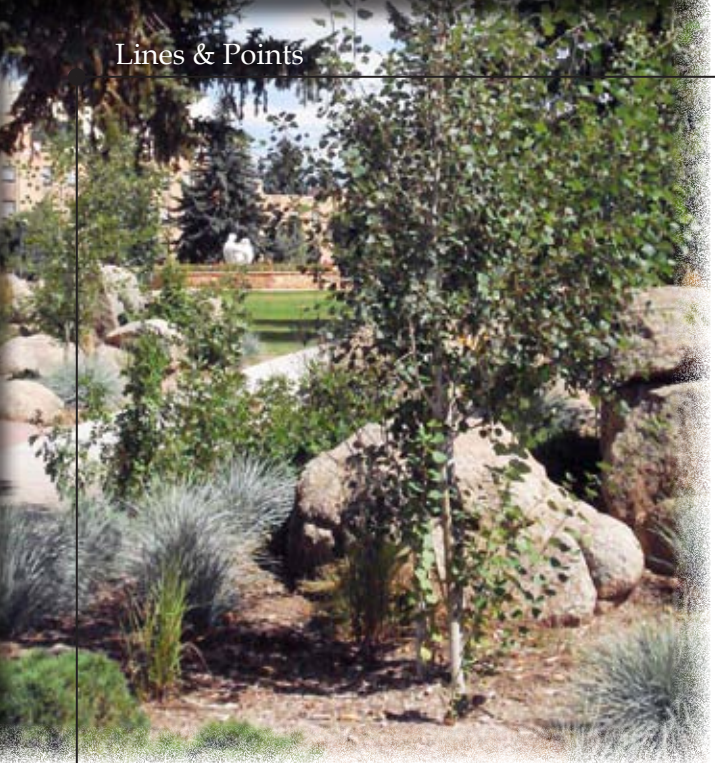
- Old Business: The 2011 PLSW Membership Roster was e-mailed to all members on July 21.

New Business:

- Recognition of the Lines and Points Award

- New Members Approved: Joseph Messner, Richard Brooks, Steven Cowley and Randy French

- Announcement: Next BOD meeting will be held at the Fall Technical Session at 5:00 p.m. on 3 November 2011



From The Prexy Pasture Party Chief

Mark Rehwaldt

Once again it is late summer and it is time to begin surveying Prexy's Pasture. The comments I get range from, "If you did it right the first time, you wouldn't have to do it each fall," to "Has it moved since the last time Prexy's Pasture was surveyed?" Everything is the same as it has always been with the boys watching the girls go by and the girls keeping an eye on the cute boys as they go by, while trying to pretend that they are actually looking through the level and reading the grade rod. On the surface it is same old, same old.

The difference between this fall and last spring is that a group of surveyors and educators got together for a strategic planning session to begin the process of plotting a course for the future of the University of Wyoming's surveying education.

The following people from the educational community, the surveying community, and with ties to the Board of Registration attended:

Lloyd Baker	Consulting Land Surveyor
Dr. Steven Barrett, Ph.D.	Associate Dean - UW College of Engineering and Applied Science
Juliet Daniels	Facilitator
Dennis Dawson	Consulting Land Surveyor
Dr. Ami Erickson, Ph.D.	Dean of Sheridan College Agriculture and Technology
Peter Hutchison	Consultant & Board of Registration Emeritus
John Lee	WY BLM Chief Land Surveyor
Jeff Miller	Instructional Designer, UW Outreach Credit Program (OCP)
Scott Pierson	Consulting Land Surveyor & Board of Registration Emeritus
Mark Rehwaldt	UW Land Surveying Program Director
Miguel Rosales	UW OCP Project Coordinator
Karl Scherbel	Consulting Land Surveyor
Dr. Reed Scull, Ed.E.	Associate Dean UW OCP
Dr. Karen Williams, Ph.D.	Chair UW BAS in Organizational Leadership
Dr. Rhonda Young, Ph.D.	Interim Department Head - UW Dept. of Civil and Architectural Engineering

The intent was to get the groups together and open up communications, to find out what surveying education is needed or wanted, what can be accomplished, how much effort will be involved, what the necessary steps are, who will be involved, and some sort of a time frame to accomplish the goal.

Things were broken down into three time frames:

Immediate - The immediate tasks are to flesh out the offering of surveying classes and prepare a financial analysis of the program.

The following classes are in the process of being developed and hopefully will be offered for the first time during the 2012/2013 academic year; Inland Water Boundaries, Least Squares Adjustments, Photogrammetry and Remote Sensing, Real Property Law, and a Fundamentals of Surveying Exam Review class. A Land Records Systems class is also in the process of being developed, it is uncertain when this class will become available. The remaining class to be developed is a Machine Control Class, which is only in the idea stage with no set time line.

A financial analysis of the Land Surveying Program will need to be prepared prior to making a request to raise tuition for the surveying classes. Currently the surveying program is being subsidized by the College of Engineering and Applied Science (the College), the Civil and Architectural Engineering Department (Department), and the Outreach Credit Program (OCP). The College, the Department, and OCP have committed to the subsidy for a three year period which will expire at the end of the spring 2012 semester. Tuition will need to be raised to replace the subsidies, along with an application to the University to make the position of the Land Surveying Director a permanent position.

Intermediate – The path to becoming a Licensed Land Surveyor via the UW Land Surveying courses and the transition from the UW Land Surveying courses to an Associates of Applied Science in Surveying Technology (AASST) at Sheridan College is not very clear or well defined. The goal is to provide a seamless transition between the UW surveying courses and Sheridan's AASST. When this goal is achieved, a student will be able to take the surveying specific course work from UW and then transfer seamlessly to Sheridan College to take the math, statistics, English, advanced writing, geology, physics, and government courses necessary to obtain the AASST.

The UW surveying classes are available via distance learning. Most of the classes for Sheridan College's AASST are available via distance learning, but it not yet possible to earn the AASST without spending time on Sheridan College's campus. The goal is that Sheridan College's AASST will be completely available via distance learning and students will be able to obtain an AASST without having to leave their homes, their families, or their jobs.

Long Term – After obtaining an Associates of Applied Science, a Bachelor's of Applied Science in Organizational Leadership with a Concentration in Land Surveying is available at UW. The problem is that this degree is not the ideal or a preferred degree for obtaining licensure as a Land Surveyor and the Wyoming Board of Registration does not recognize this degree. Some individuals on the strategic planning committee strongly suggested that UW offer a four year Bachelors degree in surveying. Currently Wyoming does not require a Bachelors degree in surveying to become licensed but some states do have the requirement. The Wyoming Board would like for land surveyors who have obtained their mother license in Wyoming to be able to meet the requirements of the most stringent states so the surveyors are not limited where they can ultimately practice. The following hurdles need to be overcome before a Bachelors degree in surveying becomes a reality; permanent faculty will need to be seated, some with Ph.D.s, enrollment will need to be significantly increased, and a Bachelors degree in surveying will need to be included in both the Department's and the College's strategic plan.

Program Pluses and Minuses – At the conclusion of the strategic planning meeting the participants were asked to identify the pluses and minuses of the UW Surveying Program. The following were identified.

Program Pluses – The students in the program are satisfied, enrollments are healthy, the program is a good deal financially for students, students find us even with the minimal marketing that UW currently

does, the program enjoys good coordination and advising, there is a good mix of classes, the program emphasizes boundary law, and the faculty offering the land surveying courses are well respected in the field. Also UW has a strong OCP with the associated infrastructure. The OCP infrastructure is a unique combination of personnel and equipment which most institutions do not have access to.

Program Minuses – There is no designated surveying director or instructor at Sheridan College. The long term financial stability of the program is a concern as the viability of the program rests on national enrollments. The College lacks a Bachelors degree in surveying which is the Board of Registration's preferred degree, and such a degree is not in the current Department or the College's strategic plan. Currently there is only one on-campus faculty member with no on-campus backup or succession plan. None of the surveying faculty at UW have a Ph.D., and the program is lacking several related courses.

In today's climate, clearing the hurdles necessary for UW to offer some type of Bachelor's degree in surveying is not an impossible task, but at best, it would be a formidable uphill battle on a good day. The current strategy is to have the Land Surveying course work in place, possibly perform a market study to determine if a Bachelors Degree in Surveying could draw enough students to be supported, and come to a conclusion as to what type of degree will best serve the potential students if the UW climate changes.

With that said, it is time to round up the junior rod persons and herd them out to survey Prexy's Pasture one more time.

Side bar article or comment:

The Boards of Registration do not recognize the University of Wyoming's Land Surveying Certificate. Because the certificate is not recognized, there is little motivation for students to obtain the certificate which requires 24 hours of surveying course work. At the time of the Strategic Planning Session, Mark Rehwaldt was aware the certificate was outdated and needed to be upgraded but there wasn't a compelling reason to update the certificate. In the interim, the Wyoming Board of Registration contacted Mr. Rehwaldt on an informal basis. The Board would like the certificate upgraded to include 30 surveying specific hours of course work. After the adoption of the upgraded certificate, the Board will note that a Land Certificate has been awarded, rather than evaluate the individual surveying specific courses required. This is in addition to a Bachelors or an Associates degree. This will ease the work load of the Board and provide a much clearer educational path for future surveyors.

ANOTHER TALE OF TWO CITIES: PART – II

By: Jack Studley, PLS



At the conclusion of my previous article I stated that I was going to refer to the Dodge/Bond survey because they were considered to be an original survey (Dodge) and a retracement survey (Bond). However, this author is of the opinion that these two surveys are not in fact related, based upon the best available evidence at the time of the surveys (1867 and 1890 respectively) and the present physical and computed positional evidence. So I have changed my mind and will refer to each survey individually in relationship to the other.

Previously, we discussed how the southwesterly corner of the Bond Survey of 1890 is a well set stone that has been preserved and maintained within an enclosure.

I shall now proceed to address the northwesterly corner stone as originally set by Bond and found today.

This stone has actually been buried for most of the time since the construction of Interstate Highway 25 (I-25) through the Cheyenne area in 1957. Oral reports from Larry Perry, PLS, state that this stone was in fact referenced prior to the I-25 construction by Malcolm Martin, PLS, with a large hole dug for re-setting the stone well below construction grade in order to preserve its location. Although I have not been able to locate field notes of this re-setting of the stone in either of the City Engineer field books or Malcolm Martin's field books, the physical evidence



Figure 1 (Inset): SW Cornerstone of the Bond Survey of 1890

on the stone itself seems to support this report. The NW corner stone has chiseled lines on the top of the stone for the original position of the point. However, another chiseled "X" and a Philips head screw was set on the top of the stone to locate the precise re-set position. I speculate that the stone was re-set in a deep hole and that it was difficult to shift or move the stone to place the original chiseled intersection in a precise position. Instead of realigning the original chiseled lines and point of intersection to the precise original position from the reference points, that the surveyors simply accepted being able to hit the reset stone and chiseled a new "X" position and set the Philips head screw on the referenced position, which we find today.

When Bond did his survey in 1890, it was reported in the City Ordinance that the original corners of the Dodge Survey of 1867 were destroyed or indiscernible. Bond's field notes make no mention of finding evidence of the original Dodge corners.

However, the original survey of the Military Reservation (MR) boundaries was completed within a week of the Dodge Survey of 1867, with Dodge's northwesterly corner of Cheyenne City being the point of beginning for this survey. A copy of this plat is available on the BLM Web site for the township. In the 1870 GLO Survey for T.14N., R.67W., this point is identified as the "INITIAL POINT" for the MR boundary. Then, in 1902, there is a GLO Survey "160 ACRE TRACT CEDED

TO THE STATE OF WYOMING", completed by Ed Stahle, which ties to the "INITIAL POINT". This tie is found in the field notes, Pg. 877, and calls for "... the initial point for the survey of the Fort D.A. Russell Military Reservation, which is a sawed pine post 4 ins square 2.4 ft above ground firmly set."

Now, the reason I make note of Ed Stahle being the GLO surveyor in 1902, is because the same Ed Stahle also completed a subdivision plat for "MENO PARK ADDITION TO CHEYENNE" recorded in April 8, 1891, in the Laramie County



Figure 2 : NW Cornerstone of the Bond Survey of 1890. Note the chiseled line down the center of the rock, the cross chisel is not as evident in this photo, but is approximately at the lower one third line in this photo. The reset "X" with set screw is to the right of the chisel line.



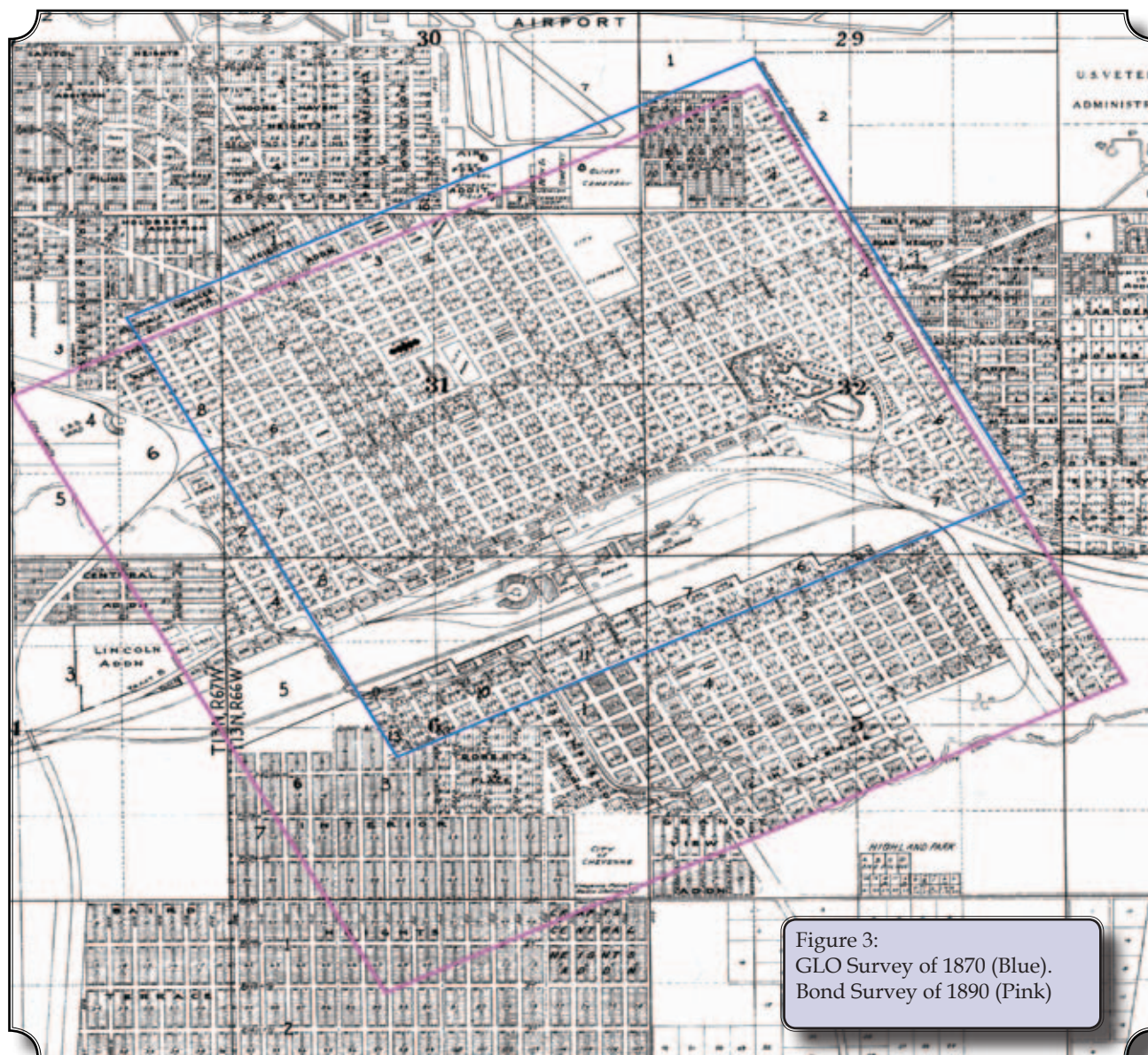


Figure 3:
GLO Survey of 1870 (Blue).
Bond Survey of 1890 (Pink)

Clerk's Office. The westerly boundary of this "MENO PARK ADDITION" was the easterly boundary of the MR, and Mr. Stahle appears to be knowledgeable about the original location of this boundary and the "INITIAL POINT" or "NW CORNER CHEYENNE CITY". A stone was located in the Burlington Northern Railroad yard with the Roman Numeral "IV" chiseled into its northwesterly face. It turns out, this stone is in the general location of the northwesterly corner of "MENO PARK ADDITION", and the northwesterly corner is the fourth corner described in the legal description for the Dedication on the subdivision plat. Thus, perhaps we have an explanation for the chiseled Roman Numeral "IV" on this stone. I also located a more recent survey completed by John A. Steil, PLS, identifying

this "IV" stone as the northwesterly corner of GLO Lot 4 of Section 36, which would be coincidental with said northwesterly corner of the "MENO PARK ADDITION".

Having observed this "IV" stone, I then computed the position of the other corners of the now vacated plat. Using these computations I located their positions on the ground. At what would be the southeasterly corner of this plat I found two other modern day survey markers platting the same general position. My position fell 0.4' north of these two points, so I tried digging to see if I ran across another stone. But to no avail, after nearly two feet this all appears to be a fill area, and I had no idea how much further I might need to dig before reaching natural ground. This was sufficient evidence to nearly persuade me that the



Figure 4 : Two survey caps found at the SE Corner of what would be Meno Park Addition. Hole dug on north side in unsuccessful effort to find original stone monument.

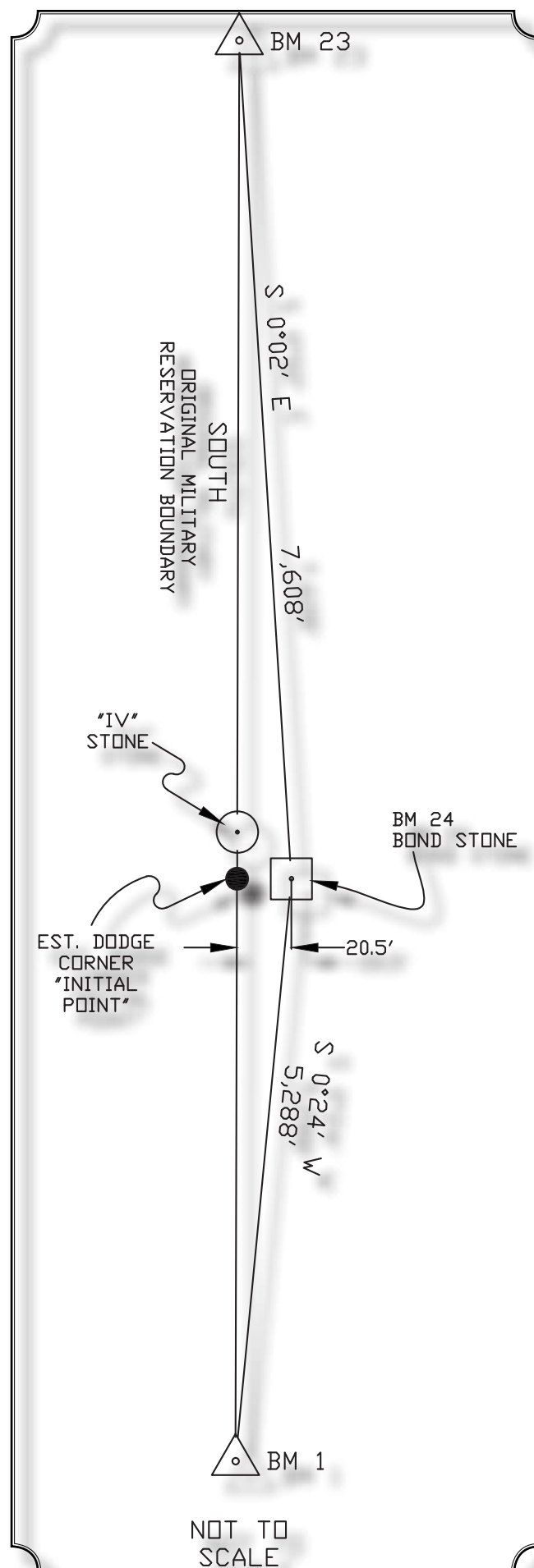
"IV" stone was in fact the original northwesterly corner of said "MENO PARK ADDITION" and northwesterly corner of the GLO Lot 4.

I then inspected the surveys of record from Francis E. Warren Air Force Base concerning their identification of the easterly boundary of the MR, and this is where things started to get really complicated.

As previously stated, the first survey of the MR was completed within a week or two of the Dodge Survey of 1867. In this first survey of 1867 we have two boundary courses with the same bearing of SOUTH (by compass) for the easterly line of the MR, indicating a straight line course for the combined calls. The next map is entitled "TOPOGRAPHICAL MAP OF FORT D.A. RUSSELL, WYO" dated March 10, 1898, and this map shows the easterly boundary as one line with a single dimensional course of $2\frac{3}{4}$ mile. The next map is entitled "RESERVATION FORT D.A. RUSSELL, WYO" dated July 23, 1909, and shows the easterly boundary with one bearing and distance. These three maps indicate a single straight line for the easterly boundary of the MR.

We then have a series of five maps with dates

(continued on Page 20)



LOCAL GEODETIC CONTROL

By: R.L. "Rick" Hudson, L.S.

WITH MY ADMIRATION AND GRATITUDE:

Having been trained in the classical methods of geodetic surveying by the staff of the U.S. Army Engineer School, Fort Belvoir, Virginia, in 1965, I have the utmost respect, admiration, and gratitude for those scientific surveyors of the USGS and USC&GS/ NGS who monumented, observed and published those stations which I have recovered, perpetuated and utilized as the basis of my local geodetic control network. It is with humility and my sincere gratitude, to each of those gentlemen, that I ask those who read this writing to reflect upon what the scientific surveyors accomplished.

PART I - A BRIEF HISTORY AND TRIBUTE

THE SCIENTIFIC SURVEYORS

Following the General Land Office contract land surveyors, who extended the Public Land Survey System over the mountains and into the Big Horn Basin of northwestern Wyoming in the 1880s and 90s, came the geodetic surveyors of the Geological Survey. Whereas the GLO mission dealt primarily with ownership, the USGS assignment was essentially scientific. As seen by the public, the former set corner monuments and the latter measured and mapped the earth, both essential activities for the settlement and development of the region.

Geodetic control in the southern portion of the basin, fundamentally comprised of latitude, longitude and height/elevation, dates from 1904 with R. B. Robertson and others of the USGS performing astronomic observations, triangulation and leveling, primarily for mapping control. Their observations, obviously predating the North American Datum of 1927 and Mean Sea Level of 1929 were referenced to a regional vertical datum, Red Lodge (RDLG).

During the 1930s, the Coast and Geodetic Survey, with commissioned officers and crews utilizing a quasi-military (and precise) methodology dating back to 1807, extended the National Spatial Reference System transcontinental (triangulation) arcs through the region, utilizing many of the stations established by the USGS and establishing more to meet the mission objectives - namely establishing precise positions and heights of monumented stations within the national network.

Additional geodetic surveying, by both the USGS and the NGS, successor to the USC&GS, into the 1990s, resulted in the present availability of horizontal (now "geometric") and vertical (now "geopotential") control stations to local surveyors.

Inset Photo:

STATION "COAL" SITS ON A HIGH RIDGE SITE, WITH REMAINS OF USGS SIGNAL

PART II - FROM MOUNTAINTOPS TO ROADSIDES

THE NATIONAL NETWORK BY CLASSICAL METHODS

We who survey in this part of Wyoming are indeed fortunate that nearly all of the previously established stations are recovered in good condition. This is partly due to durable monumentation, but more likely due to less population and construction activity than in most of the country. Triangulation, and later electronic traverse, required stations to be intervisible and resulted in many sites being located on mountaintops and ridges. Generally steep and rocky, these sites are only infrequently visited by the public.

Astronomic and triangulation observations were very labor intensive, nearly always performed at night, and often required crews to remain at the stations for long periods. Physical fitness, mental alertness and survival skills were essential characteristics of all crewmembers. The quasi-military approach was well suited and necessary for successful completion of each survey campaign.

LOCAL NETWORKS BY LOCAL SURVEYORS

During the early 1960s, the Thermopolis Town Engineer, Casper & Thermopolis Engineering Services, established a local control network by triangulation from the NSRS stations in the immediate vicinity. While no public record of those "TRI. STA." brass-capped iron pipes has yet been discovered, I have recovered and tied several of the stations, thus perpetuating the work of R. Lee Donley and others of C&TES. Unfortunately, the 2½ in. dia. brass caps were wired to the 1 in. dia. iron pipes and many of them have disappeared - innocent victims of opportunistic thievery.

Shortly after relocating my practice from Cheyenne to Thermopolis in 1980, I began extending control from NSRS second-order triangulation station Club (and Club Azimuth Mark) south of town, northward. Using a "T 2" theodolite and a "3800" distance meter (and later a "total station") I traversed where and when needed, vowing to someday occupy station Thermopolis atop a locally prominent mountain. First lesson learned: I should have climbed up there sooner rather than later. The distance at about six miles checked well, but the azimuths required a 10 second rotation.

NSRS STATION COAL, PID OW0249,
TYPICAL DISK IN ROCK OUTCROP



Several other NSRS triangulation stations, and their azimuth marks or intersected stations, served as origins for other traverses during the last two decades of the twentieth century. Initially, all work was referenced to NAD 27 and NGVD 29. In 1986, the long-awaited NAD 83 was first published, followed in a few years by NAVD 88. These datums resulted from simultaneous adjustments of the entire network and were justifiably proclaimed by surveyors as the ultimate data for horizontal position and elevation. Refinements to NAD83(86), notably the High Accuracy Reference Network (HARN) in 1993 and the densification thereof in 2000, followed by the current network readjustment in 2007, NAD83(NSRS a/k/a 2007), introduced us plane-thinking surveyors to the realities of modern-day geodetic surveying. Second lesson learned: 27/29 and 83/88 are cousins not siblings, and algorithms are robots not geni.



FROM T-2 AND 3800 - TO TOTAL
STATION - TO GPS/GNSS RECEIVERS

Because of the lack of a Continuously Operating Reference Station (CORS) within the Big Horn Basin until 2008, those of us who established local geodetic control networks first occupied the existing USGS and USC&GS stations; and we later utilizing GPS methodology originating at the HARN stations.

USING GPS / GNSS METHODOLOGY

Just as electronic distance measurement (EDM) greatly reduced the time and effort to establish local geodetic control, so too have the Global Positioning System (GPS) and now the Global Navigation Satellite Systems (GNSS) enabled local surveyors to almost effortlessly (compared to classical methods) determine georeferenced positions of latitude, longitude, ellipsoid height, and/or state plane coordinates and orthometric elevations. Accurate longitude had been the elusive quarry of mariners, astronomers and surveyors for centuries - now we take it, as well as the ability to record very accurate time, for granted.

We no longer have to pack heavy equipment, by hand or back, to mountaintop NSRS stations. Now we drive heated/air-conditioned vehicles to roadside stations, set up light, compact equipment and, after relatively brief occupations, obtain positions that would (and still do) flabbergast the (us) oldtimers.



NSRS (BM) STATION "V 327", PID OW0216 IS A TYPICAL
ROD IN BOX WITH COVER ALONG U.S. HIGHWAY 20 IN THE
WIND RIVER CANYON

of monumented (and reoccupied) stations is the NGS provided Online Positioning User Service (OPUS) and subsequent variations. Due to the spacing of CORS from most localities in the Big Horn Basin and particularly from Cody, positions, especially elevations, thus determined are slightly less accurate than those provided from the HARN. Depending upon individual project requirements, OPUS can provide adequate local geodetic control in many cases.

An alternative to the traditional network

In 2009 I established a base station tied directly to the HARN stations. Although used only when needed, station RLHLS ARP is my cheap, imitation CORS. The possibility of a real time network in the Big Horn Basin is too futuristic to even consider during my career.

With the relative ease of obtaining accurate positions we can devote even more effort to one of the essentials of control and boundary surveying, the perpetuation of station marks and corner monuments. In the case of NSRS monumented (now "passive") stations, be advised that NGS has not performed, nor will it ever again perform, mark maintenance in the field. That responsibility is ours my fellow land surveyors; as has been the case with Public Land Survey System corner monuments since 1967, mandated by our Corner Perpetuation and Filing Act.



USGS BM "2 ECD" IS EAST OF THERMOPOLIS
A GOOD SITE...BUT A TOUGH SETUP.

PART III - THE MATH, MARKS, AND PAPER TRAIL

PRECISE AND ACCURATE BUT NEVER EXACT

The analogy using a firing range target demonstrates the relationship between precision and accuracy; a tight group near the edge is precise while a wider group near the center represents accuracy. Hitting Bucky's tail three times won't drop him, but three rounds to the body will. Wherein classical methodology relied

heavily upon a few measurements, made very precisely, current GPS/CNSS methodology uses many, many measurements of lesser precision to achieve greater positional accuracy than was ever possible using optical instrumentation. Ask anyone who performed astronomic observations for azimuth or position using theodolites and chronometers.

Regardless of the methodology used, achieving accuracy has always been a fundamental goal for local geodetic control. The terms "network" and "local" accuracy are now being applied to control surveys to better define spatial relationships; superceding the classical "order", just as parts per million have replaced one part in . . . thousand.

An excellent test of equipment, methodology and personnel, which also instills confidence prior to establishing or extending local geodetic control, is to occupy the four stations of an NGS calibration base line (there are several within Wyoming) and compare your results to the published results.

TO THE RIGHT OF THE DECIMAL POINT

Although the proper designation is significant figures, I often use the above terminology for simplicity. While the concept is purely mathematical, the application becomes almost intuitive with experience. Visualization of an angle of one second subtending one foot at a distance of 40 miles reminds me to "round off" azimuths and to also report distances realistically.

A VIEW OF THE DECENT FROM STATION
"THERMOPOLIS" (PID OW0244) ATOP ROUND TOP





SETTING REFERENCE MONUMENTS FOR HARN
STATION "L49", PID OW0104

Any distance measurement, obtained during a typical land survey, which is reported to less than 0.01 foot flashes false precision rather than reporting honest accuracy. Similarly, coordinates representing surveyed positions and elevations, should be representative of the methodology and instrumentation, and sometimes the personnel, used. NSRS latitudes and longitudes are now published to the "fifth place" in seconds, regardless of the original order assigned to the station. Visualization of one second of longitude, about 73½ feet in this part of the state, shrinking to less than 0.001 foot at the "fifth place" should remind us of reality. I carry a nickel as a reminder of a realistic position measurement (the 0.07 ft./2 cm diameter, not the 0.007 ft./2 mm thickness).

METADATA

Often neglected but increasingly essential is the publication of metadata, or data about data, for our land surveying activities. This becomes critical when reporting local geodetic control. By definition, local geodetic control is derived from the National Spatial Reference System, which has become increasingly more complex than it was in 1807, or 1927 or 1983. In the context of warnings on the label, I offer this one: "Failure to provide adequate metadata will result in rejection of data and diminished professional courtesy by present and future peers."

STATION SELECTION AND PERPETUATION

Station selection consists of two elements, monumentation and location. As with corner monuments for land surveys, station monuments for local geodetic control must be constructed of durable materials, identifiable, and as permanent

as practical. Government agencies have gained a vast amount of experience regarding those attributes; saving us local surveyors a great deal of trial and error experimentation. As a matter of personal preference, I use an existing monument whenever possible. Concrete monuments with bronze disks or tablets, bronze or aluminum disks in rock outcrops, iron posts with brass caps, stainless steel rods in boxes with covers, and similar monuments. Those set by the USGS, USC&GS, NGS, GLO, BLM and WYDOT are prime candidates. Similar monuments, previously set by myself or other local surveyors, are used without hesitation. Only as a last resort, do I set a new monument. Using a PLSS corner monument as a control station serves both my cadastral and geodetic personalities.

Station location, as mentioned earlier, has migrated from mountaintops to roadsides. Not entirely, of course, but certainly to the extent which is practicable. While that has lessened the time and effort for initial occupation and revisitation, it exposes stations to the increasing danger of displacement or destruction. Even with reference monuments, a displaced or destroyed station that is reestablished requires time and effort, and is never regarded as reverently as the original. While some stations (and corners) are "accidentally" destroyed by construction activities, others are "willfully" chiseled and yanked from their surroundings by unseen persona non grata committing criminal acts.

Static sessions afford ample time to perform mundane but essential chores such as removing vegetation, blow sand and trash, cleaning out monument boxes and repairing signs. Digital photographs of station marks, sites, and accessories are excellent for station perpetuation.

(continued on Page 21)



RLHLS BASE AND ARP STATION, ADMITTEDLY A
CHEAP IMITATION CORS STATION

Project Management

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

The buzz words are project management (PM). They are one of the set of terms [like TQM - total quality management (sometimes referred to as "total quality mismanagement"), "QC" - quality control, and "QA" - quality assurance] businesses and government use to indicate a high level of productivity, efficient management, and economic productivity to produce a product or outcome. MBA academic programs dedicate at least one course to the subject.

One of the prime factors is to develop or have established several levels of command. These command levels provide the forum for the ability to have preformed work be checked and edited by one or more independent individuals. Many organizations believe that checking data input/reduction and editing the final work product is a minimally necessary activity which is unnecessary and elevates the client's bill. However, careful study of liability cases, particularly related to construction related matters, indicates that many of the cited problems in litigation were the result of not carefully addressing the preparation and execution of the surveys. In one instance, a project surveyor noted a discrepancy on an architect's paper and electronic plans concerning the layout of a building. Instead of contacting the architect and informing them of the discrepancy between the paper produced plans and the electronic version of the plans, he selected one submission. It resulted in a location of the foundation not satisfying the regulatory minimum set backs. Oops!

The second factor is failure to adhere to a minimum quality level of service stipulated in the contract or failing to define an agreeable level of quality of the provided service. In many instances, the client is not knowledgeable as to the level of "services" required to have a quality product at a reasonable fee. Then it is the responsibility of the professional to indicate the level of services required and the fee thereby associated. If there is more than one alternative for the requested service, then economically reasonable approaches should be identified and presented for the client's selection. Whatever work product is required,

the professional should have a documented set of instructions for making the observations and ensuring that resulting data statistically satisfies the minimum constraints imposed for the project. "Check lists" are a viable approach of ensuring that the desired work product provided is adequate.

The third factor is to have a definite office administrative system. This is sometimes referred to as the "chain of command", which is a simplistic approach. The real problem is establishing these lines of communication (and authority) from the front office to various offices, departments, and individuals. Identify the personnel at each level in the organization with their level of authority for communicating to individuals and organizations outside the office and have the authority to "speak for the chief executive officer". Change orders on a construction project usually are not the purview of a technician, but only within the authority of the design engineer/architect or their identified representative (sometimes called the contracting officer representative). Also, clear lines of communication and authority minimize issuance of conflicting instructions and "blind siding" of senior level staff and managers. Also, liability insurance companies look intently at this problem in order to assess the cause of the problem and minimize damage payments.

The fourth factor is payment for provided services. This problem is serious. The problem results from the complex nature of the project economics. Until the last three decades, the economic factors which provide increasing item prices have followed classical economic philosophy. Historically, it was relatively simple to quote the fee for construction services to be x percent of the contract bid quotation. This is no longer true as the construction contract bids have multi-faceted payment schedules based upon labor, management, and material costs. Also, the relatively new approach of "design-build", while innovative, have little historical data to provide surveyors with viable data to provide estimates for surveying services.

The fifth factor is documentation of support services required for providing contracted services. This problem results from individuals failing to document. Suppose that you have a contract to provide a service requiring a particular piece of instrumentation, and this instrument

must be leased. Then, a contract must be made with the firm providing the instrument. Included in the terms of this contract should be the process of notification when the instrument is required (including the lead time of notification, the calibration of the instrument, etc.), the rental fee, method of delivery, training of personnel, and the penalties for non compliance. In order to justify damages, written records are required. A significant number of cases of litigation in this arena have been rejected by the courts, because the individual seeking damages has failed to provide adequate documentation.

The sixth factor is to keep records of all meetings with clients and others about the project. The simplest form is the "Memorandum for Record" (MFR). This document lists the attendees, states the matters discussed, and the conclusions reached (if any). After the document is drafted, "preliminary" copies should be transmitted to all attending parties with the request that each recipient verify the validity of its contents. Non responses mean acceptance, which should be so stated in the MFR. These documents and receipts are important in future litigation.

The seventh factor is to read your contract and provide the services you agreed to provide. Many surveyors rely on the standard AIA and other professional services contracts for the project. In many instances, these contracts do not address the technical and professional issues. However, the surveyor should carefully compare the terms of the "standard contract" with the technical requirements of the specific project to ensure that an excessive burden of liability is not saddled upon the surveyor.

The surveyor must realize that there are two components which can be argued as to duties, responsibilities, and services provided. The first component is to address the perceived duties as outlined in the contracts and the documents supporting compliance. The second component is only applied when the first component is ambiguous and conflicting. Then, outside experts are called in to state a level of acceptable performance based upon the current level of compliance by the practicing professionals in the area of the project. This is sometimes called "standard of care". Liability insurance companies rely on the latter principle in providing payment

and future insurability of the professional.

The surveyor should write important matters down. Things like change orders, agreements and decisions, including the rationale are particularly important in determining payments and responsibility. Honestly addressing issues as they arise ensures project completion and profitability. Keep the customer or client's needs and requirements in view. Changes in client's requirements and not focusing on the client's needs will produce project failure.

In conclusion, MP is a multifaceted program. It requires diligence in execution and imagination in identifying those matters which could impair success. Small and large organizations will profit from a conscientiously designed project management program.



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PRE-REGISTRATION:

FEE: \$100 PLSW Members
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\$175 Non-Members

A \$20 late registration fee will be added to all registrations received after October 28, 2011.

AGENDA

November 3rd	7:00 a.m. - 8:00 a.m.	Registration
	8:00 a.m. - 12:00 p.m.	Seminar
	12:00 p.m. - 1:00 p.m.	Luncheon
	1:00 p.m. - 5:00 p.m.	Seminar
November 4th	5:00 p.m. - 9:00 p.m.	Social Hour
	7:00 a.m. - 7:45 a.m.	Breakfast Buffet
	8:00 a.m. - 12:00 p.m.	Seminar

Physical Models Used (and Not Used) in GNSS Processing

Global Navigation Satellite System (GNSS) data processing requires many different numerical models to describe the physical processes affecting the positions of the satellites and points on the ground as well as the propagation of the GNSS signals from the satellites to the user. Some of these models are commonly known: satellite orbits, tropo and antenna corrections are examples from this group. Others are probably less well known: phase wrapping, atmospheric gradients and solid Earth tides are examples from this group. In this presentation, many of these models will be described with a focus on broader conceptual understandings rather than detailed technical descriptions. Real examples from data processing will be included whenever possible thereby adding the magnitudes of these physical processes to your understanding. The ultimate goal is to give you a better awareness of what your GNSS processing software should be doing to give you the accuracy necessary for your needs.

New Developments at the National Geodetic Survey

The National Geodetic Survey, NGS, traces its history back to the early 1800's. Although its mission has adapted to changing times and technology, this two hundred year history is alive in the NGS today. Using an overview of the NGS as an organizing framework, some NGS activities of particular interest to the surveying communities will be highlighted. Among the activities highlighted in this presentation are: improved coordinates for the CORS and a large subset of the passive mark networks (NAD 83(2011) and NA2011); the related work to define a new hybrid geoid model providing improved consistency with these new coordinates and velocities (GEOID12); the Gravity for the Redefinition of the American Vertical Datum (GRAV-D) mission to create a "snapshot" of gravity across the United States in unparalleled detail; the Online Positioning User Service (OPUS) providing virtually hands-off, high-accuracy GNSS data processing; and the creation of guidelines to help real-time network providers more rigorously tie their networks to the global and national datums.

New Developments in OPUS

The On-line Positioning User Service (OPUS) is a National Geodetic Survey tool that provides you with a National Spatial Reference System coordinate via email in seconds using your own GPS

LOCATION AND LODGING

A block of rooms has been reserved at the Best Western Ramkota Hotel, 800 N. Poplar Street, Casper, Wyoming. Rate: \$70.00 per night. Telephone: 307-266-6000.

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NSPS MAP/PLAT COMPETITION

The Wyoming Land Surveyors NSPS Map/Plat Design Competition will be held in conjunction with the seminar. Send your entries to Bill Fehringer or bring them to the seminar.

data file. Several notable enhancements have been implemented or are pending for OPUS. OPUS-Projects is a new option providing tools to handle GPS projects involving several sites occupied over several days. OPUS-Projects includes project visualization and management tools, enhanced processing options, and "one click" publishing for an entire project. OPUS is testing a new static processing strategy. By including more CORS at various distances and more sophisticated geophysical models, this new strategy improves the reliability of the results without sacrificing flexibility. OPUS-RS also offers a new CORS selection strategy which improves reliability and expands the regions in which this is a viable processing option. Underlying these enhancements are new CORS coordinates derived from a recently completed global GNSS network solution. This solution provides improved coordinates for all included CORS that are consistent with recognized reference systems such as the ITRF2008. These and other new developments will be described.

Dr. Mark Schenewerk

Dr. Schenewerk received his B.S. in Physics from the University of Missouri at Rolla and his Ph.D. in Astronomy from the University of Illinois at Champaign-Urbana. After a short tenure as a system scientist at the National Radio Astronomy Observatories, Dr. Schenewerk joined the National Geodetic Survey in 1987 where he began developing GPS high-accuracy processing software. Current activities include the development of Global Navigation Satellite System (GNSS) software tools for GPS and GLONASS satellite orbit determination and other activities, and the development of OPUS-Projects: a web-based, multiple-site solution toolset compatible with the OPUS suite.



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Proposed Changes to PLSW By-Laws

27 August 2011

To the Members of PLSW

The following changes to the PLSW By-Laws are proposed:



Article II, Section 1, Members 0, (found in page 8 of the By-Laws):
“Members in good standing, Honorary Members, and Life Members shall be the only persons eligible to vote on business at the annual state meeting or hold office as State President, President Elect, Secretary/Treasurer or Director.”

Article V, Section 1, Number of Directors, (found in page 17 of the By-Laws):
“The business and affairs of this corporation shall be organized, managed and controlled by a Board of Directors consisting of one (1) Director from each Chapter Area, as hereinafter described, In Article X, the President, the President Elect, the Secretary/Treasurer, and the immediate Past President of the corporation. The number of Directors may be increased or decreased from time to time by Amendment to these By-Laws; provided, however, that the total number of Directors shall never be less than three.”

Article VII, Section 2 Number, (found in page 22 of the By-Laws): *“The officers of the corporation shall be a President, a President Elect, a Secretary/Treasurer, each of whom shall be elected by the Members and Life Members of the corporation. Such other officers and assistant officers as may be deemed necessary from time to time may be elected or appointed by the Board of Directors. Any two or more offices may be held by the same person, except the offices of President and Secretary/Treasurer.”*

Article VII, Section 7 Vice President, (found in page 23 of the By-Laws): *“Section 7 President Elect I n the absence of the President or in the event of the President’s death, inability or refusal to act, the President Elect shall perform the duties of the President, and when so acting, shall have all the powers of and be subject to all the restrictions upon the President. The President Elect may sign, with the Secretary/Treasurer, membership certificates and membership cards, and shall perform such other duties as from time to time may be assigned to said President Elect by the President or by the Board of Directors.”*

Article VII, Section 8 Secretary/Treasurer (e), (found in page 23 of the By-Laws): *“sign with the President or the President Elect membership certificates and membership cards the issuance of which shall have been authorized by Resolution of the Board of Directors;”*

Please VOTE your ballot!

Envelopes will be opened and ballots tabulated by the Teller at 1:00 pm on 2 February 2012.



(continued from Page 10)

starting in May 1910, Nov. 1931 (revised Jan. 1951), Aug. 1935, Mar. 1949, and Oct. 1998. The earliest of which very specifically described the Bond Stone of 1890 as the "INITIAL POINT". Each of these maps then identify along this easterly boundary of the MR as Boundary Monument No. 23 (BM 23) to the north (the northeast corner of MR), Boundary Monument No. 24 (BM 24) as the Bond Stone of 1890, and then Boundary Monument No. 1 (BM 1) to the south (the southeast corner of MR). Each of these maps also recite courses from BM 23 to BM 24 as $S0^{\circ}02'E$, 7608' and from BM 24 to BM 1 as $S0^{\circ}24'W$, 5288'. Thus showing a significant 26' angular deflection at the Bond Stone (BM 24) in this easterly boundary of the MR. My observation of these three points resulted in a 25' angular deflection and distances within 0.3' of record. However, the "IV" stone falls 20.5' westerly of this line.

I computed a straight line between BM 23 and BM 1, and found that the "IV" stone fell within

0.4' of this computed line. This indicates that Ed Stahle surveyed the easterly MR boundary as a straight line between what we have today identified as BM 23 and BM 1, along with the field evidence he recites in the GLO Survey of 1902.

The "IV" stone is located in Section 36, T14N, R67W, 6th PM. I observed the present NE Corner of Section 36 (not an original stone), and projected westerly the record distance for the closing corner on the MR boundary. This projected position fell 2.97' east of the straight line between BM 23 and BM 1; and 11.37' west of the line from BM 23 and BM 24 (Bond stone). This closing corner projection falls nearer to the straight line survey of Ed Stahle between BM 23 and BM 1. Unfortunately, there was no closing corner or tie on the MR boundary in the GLO notes for the Township boundary survey of T14N, R67W, along the southerly line of Section 36, to further establish the original MR boundary in relation to the original GLO Township survey of 1870. I found this to be curious.

In conclusion, it is this author's opinion that the "IV" stone was set by Ed Stahle as the northwesterly corner of MENO PARK ADDITION, coinciding with the northwesterly corner of Government Lot 4 as called for by John A. Steil, PLS, and located on the original easterly boundary of the Military Reservation. Also, the Bond stone of 1890 set at the northwesterly corner of Cheyenne City is not located on the original Military Reservation boundary, but is located 20.5 easterly of the boundary. Therefore, it is not located in the same position as the Dodge corner of 1867, and the Bond Survey of 1890 is not a "faithful" retracement of the Dodge Survey of 1867.

Needless to say, this is a project in progress, and I would like to hear other opinions concerning the logic of my analysis. Or, if you have further questions, I would be happy to respond. I have found many times that questions and comments often cast a different viewpoint on how to look at evidence.

The next article and review of the remaining corners of both the Bond Survey of 1890 and the GLO Survey of 1870 are not as nearly involved as this one.

(continued from Page 15)

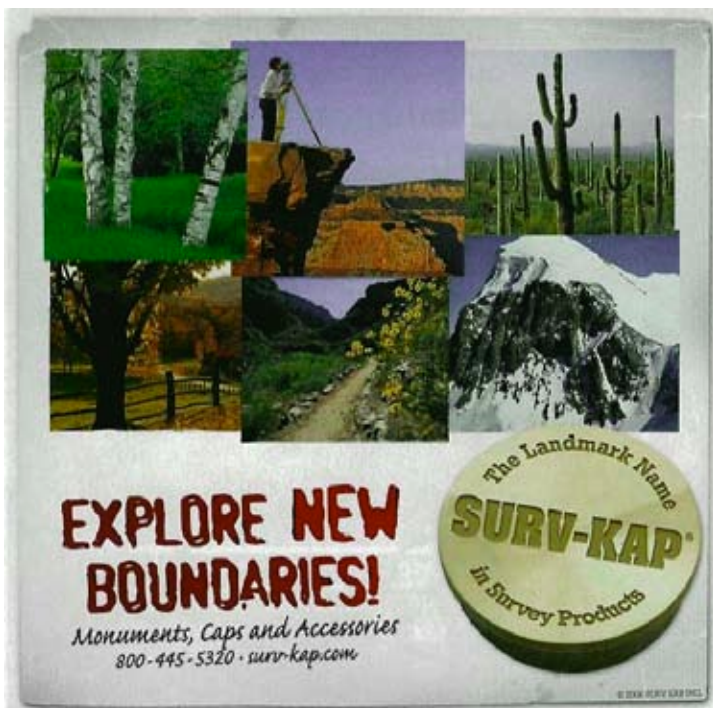
PUBLIC DOCUMENTATION

Public documentation of local geodetic control, while not necessarily required, certainly offers benefits I feel are worth the time and effort. Others may believe such information is proprietary, or have other reasons for not entering survey data into the public record. One size does not fit all.

In either situation, be advised of, but not alarmed by, the reporting requirements since 1994 of the Wyoming Coordinate System NAD 1983 legislation. While I rely upon corner record reports to provide the necessary metadata, others may have found something better.

POWER OFF, RECEIVER SHUTTING DOWN

Pushing the power button to end an observation session, I hear "Power off, receiver shutting down." from a tiny speaker inside a compact GNSS receiver. It is always a welcome announcement since it signals completion of yet another surveying observation. I load up and head off to the next station, usually down the road but sometimes up the mountain. After two score and seven years, this old 'veyor still appreciates his introduction to geodetic surveying by "classical methods" - just don't expect to ever again see me turning two sets of 16 positions to a heliotrope ten miles away on another mountaintop.



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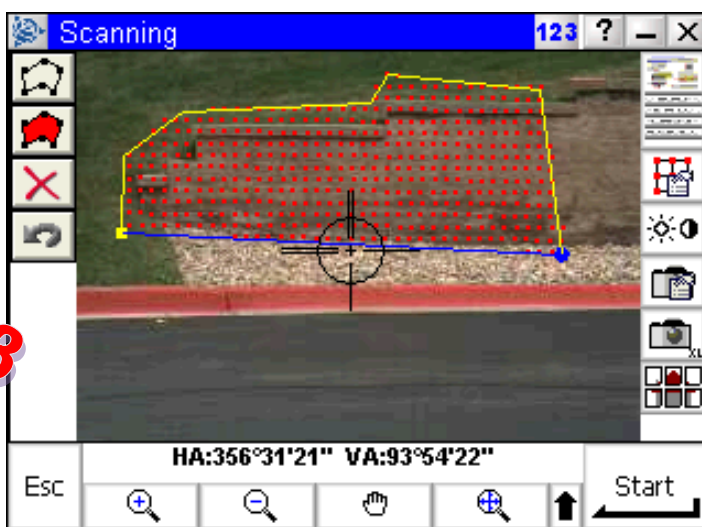
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