Missouri Surveyor

A Quarterly Publication of the
Missouri Society of Professional Surveyors

Jefferson City, Missouri March 2012

MISSOURI SURVEYOR

CALENDAR OF EVENTS

2011-2012

May 10-12, 2012
Board Meeting and
Spring Workshop
Lodge of Four Seasons
Lake Ozark, MO

July 13-14, 2012
Board Meeting and
Golf Tournament
Minimum Standards Workshop
Lodge of Four Seasons
Lake Ozark, MO

August 15-17, 2012
Land Surveyor's Review Course
Best Western Hotel
Jefferson City, MO

October 11-13, 2012
55th Annual Meeting
and Convention
Hilton Frontenac Hotel
St. Louis, MO

December 1, 2012
Board of Directors Meeting
MSPS Office
Jefferson City, MO

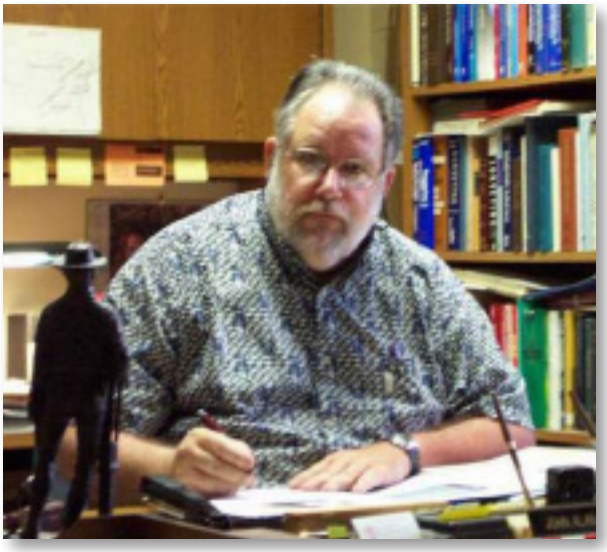
October 10-12, 2013
56th Annual Meeting
and Convention
Tan-Tar-A Resort
Golf Club, Marina
and Indoor Waterpark
Osage Beach, MO

October 2014
Joint Annual Meeting
with Kansas Society of
Land Surveyors

John Alan Holleck, Editor

Notes from the Editor's Desk

John Alan Holleck



Spring done sprung, after what must be considered a mild winter. I do not think that I can remember a winter so un-winter like, with very little snow and very few days of sub-freezing temperatures. Moving on I must again apologize for the lateness of the *Missouri Surveyor*. I seem to be becoming recalcitrant in my old age, which is not a good thing for an editor. Sandy tries to keep me focused but I struggle against the authority. Enough said on to the March issue.

The issue opens as always with my "Notes" followed by President Joe Carrow's "President's Message." "A Question of Ethics" by Joe Clayton and Chris Wickern follows with an appeal to recordation. Next, Robert A. Daniels writes of some simple ideas with regard to "The Client." Dr. Richard Elgin tells us about a Ripley County survey in a "Letter to the Editor." Funny stuff—thanks Dick. Dr. Joe Senne, Professor Emeritus at Missouri S & T University follows with news of the upcoming "Transit of Venus," a seldom seen occurrence. Reprinted from the Empire State Surveyor is "Seven marketing tips to help you through the downturn" by Paul Fahey. The subtitle suggests that the tips fit any size company. Next follows "Managing Employee Benefits in Difficult Economic Times" another appropriate article for these times. Included in this issue is a copy of the upcoming Spring Workshop flyer.

To open the second half of the journal, we print a flyer for the Surveyor's Review Course. This is followed by a rather technical article entitled "Some recent Advances in GPS—Precise Point Positioning" by a couple of professors from the Ryerson University in Ontario. "Action Update on Unified Organization" by Bill Coleman refers to the "new" NSPS no longer under the ACSM banner. An interesting article on the history of "Units of Measure ends the writing in the March issue of the *Missouri Surveyor*." I am glad we do not have to calculate area in "hides." BTW, how do you like the color ads?

THE MISSOURI SURVEYOR

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Missouri Society of Professional Surveyors

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President's Message

Joe Carrow, PLS

I hope this message finds everyone with a blossoming work load, to go along with great weather we are having and the very mild winter we just experienced.

On the legislative front MSPS has a bill sponsored by Rep. Bart Korman (High Hill) and Senator Dan Brown (Rolla). The bill is intended to give Land Survey Program more control over its financial situation and would make the Land Survey Advisory Committee a commission. The house bill is HB 1395 and the senate bill is SB 814. You can read these bills at www.senate.mo.gov or www.house.mo.gov.

The Licensing Board would like for MSPS to sponsor a bill to increase the educational requirements to be registered as a land surveyor to thirty hours. MSPS has a committee working on the details, and hope to have something ironed out before the 2013 legislative season. There has also been discussion of implementing the requirement to have a bachelor's degree phased in over time. Comments are always welcome and appreciated. Send your comments to MSPS at msps@missourisurveyor.org.

On another front MSPS is in negotiations with Dr. Dick Elgin and Dr. David Knowles to publish a Missouri GLO history book – similar to the book they have published in Arkansas. We hope to have this book by late 2012 or early 2013.

The annual Spring Workshop is scheduled for May 11-12 at the Lodge of Four Seasons and is titled "Everything Surveyors need to know about Realtors, Title Companies and Client Communications." We can all use a refresher on how to communicate with our clients and this presentation will be made by Larry Phipps. Larry was in Missouri a couple of years ago and presented at the Spring Workshop. He is very knowledgeable on a multitude of topics and a very interesting speaker.

In October our annual conference will be in St. Louis at the St. Louis Hilton Frontenac Hotel. Education Chair Dan Govero is always open to suggestions for topics. Remember these workshops are for you, the member. Contact Dan and give him suggestions on what topics you would like to hear.

In closing I'd like to remind everyone to get involved in your Society. There are many committees that are still forming and need your ideas and input. You can access a list of the committees on the website at www.missourisurveyor.org.

Front Cover: This 2" Iron Pipe is at the corner to Sections 26, 27, 34 & 35, Township 45 North, Range 9 West, Osage County, Missouri. The first GLO survey was in 1817 by Thomas Rector where he set a wood post with 2 witness trees; A 15" Black Oak N75°E 18 links and a 14" Black Oak S25°W 50 (or 60) links. The second GLO survey was a dependent resurvey in 1847 by Lampton, where he found both Black Oak witness trees with the following note: " South between Sections 26 & 27, Twp. 45N, Rng. 9W, 11.76 Chains a point 126 lks, west of the corner to Sections 26, 27, 34 & 35 which is a Black Oak (now 20"), N75°E 18 lks. And a 14" Black Oak (now 20") N50°W 19 links, the latter tree said in the original field notes to bear S25°W 50 lks." This corner is on the south side of the Missouri River in Osage County.

A Question of Ethics

Joe Clayton, PLS & Chris Wickern, PLS

The Territory of Missouri passed requirements to place certain boundary surveys into the public record in 1814. County Surveyors and their deputies were the only ones envisioned by law to perform these services. For the next 140 years, the only two exceptions to this law were US Deputy Surveyors, and by the mutual consent of the parties. Our rules today perpetuate and enhance these original requirements. All boundary surveys have an affect on all the near-by properties, and so have never been a private matter between a client and the surveyor. Our survey recording laws are a model of consistency. They are a common sense requirement to place publicly acquired, surveyed, and monumented boundaries into the public record, and they exist for only one reason. They exist to protect the public.

County Surveyors were not the only ones performing boundary surveys. The practical surveyor applied the business of surveying as an unregulated trade. They worked for many years under the exception of 'the mutual consent of the parties'. Time passed, and the business of the practical surveyor grew. The exception for the mutual consent of the parties was widely ignored and the accepted practice evolved into performing services for the benefit of one client. Some have asked, 'if the practical surveyor had no authority, then why didn't the Courts toss them out when disputes were adjudicated?'

The answer maybe straightforward, we have the executive, legislative, and the judicial branches of government. We did then, and do now have laws granting authority to specifically qualified persons to conduct boundary surveys, and regulations that set standards of practice for those surveys. These laws were enacted through the legislative branch. However, the judicial branch drew a line because the Courts readily recognize that legislature can create laws, but they cannot legislate what is or is not evidence in Court proceedings. They will consider the value of a survey and the surveyor presented as evidence, they will make the determination, and they hold that view through today. They have (and will) accept testimony and surveys performed under authority granted by the State, by unlicensed people, by Surveyors licensed in other State's, etc. Later, they may be charged for practicing without a Missouri license, but the Court determines what is or is not expert testimony and evidence.

The State is now enforcing our licensing laws, but these laws did not exist until 1954. Boundary surveyors became regulated, and a license to perform these important professional services is now issued to those who meet the requirements. The unregulated business of the practical surveyor applying their trade was to fade into history. In practice however, the practical surveyor is alive and well. We perpetuate the evolved standards taught to us by the practical surveyor applying their trade and call it acceptable.

Is it?

The definition of Land Surveyor is found in our statutes. Section 327.272, "… Any person who practices in Missouri as a professional land surveyor … the *adequate* performance of which involves the special knowledge and application of the principles of mathematics, the related physical and applied sciences, and the relevant requirements of law, … that affect real property rights …" Surveyors understand that boundary establishment, retracement, and reestablishment affect far more than just our client today. No other profession is authorized to make these crucial determinations. We Land Surveyors are ethically governed by our Code of Professional Conduct. 20 CSR 2030-2.010 states, "(2) … These rules of professional conduct are binding for every licensee. Each person licensed pursuant to Chapter 327, RSMo is required to be familiar with Chapter 327…" It is not the client nor government official that has the knowledge, competency, or ethics requirements. The Land Surveyor is the one person with 'the special knowledge of the relevant requirements of law'.

This is not the inherited standard of the practical surveyor of days gone by. Practical surveyors had no authority to survey; they simply did not exist in the eyes of the State. Licensed surveyors today are still not held to the ancient and historic requirements to perpetuate evidence of boundary surveys. (Exceptions do exist. Local requirements in cities and some counties generally exceed any current or proposed recording requirements. These surveys are already exempt in our current statutes (60.657).) It seems we have been taught, and we accept as our standard, the recording practices of the unregulated. In essence, we have accepted and apply the standards of practice developed by those who may no longer lawfully practice. It is a recording standard that is no standard at all.

Many of us perpetuate the standard handed down to us, and some go to great lengths to do so. Many laws governing our practice have a clear intent to record certain surveys. We point to how we were taught and state, 'we've never done it that way', or 'many of these laws only apply to the County Surveyor'. Yes many of these laws do specify the County Surveyor, but the intent of the law has always been to place certain boundary surveys into the public record. The laws exist to protect the public, and the County Surveyor was the *only surveyor* with authority at the time most of these laws were created. Many surveyors today search for work a-rounds and loopholes to maintain the standards handed down to us. Even some County Surveyors have been known not to record surveys as

required. They state the survey was performed under their 'private license', and not through their Office as the County Surveyor. Another common work-around of the clear intent is to advise the client to record a description for a new parcel being created; then have it surveyed. This makes it a survey for an existing parcel, even though they are establishing boundaries on the ground and are the first surveyor ever to do so. Nothing to it, just change the conditions of the survey so that the standards given to us by the businessmen practicing the trade of land surveying are perpetuated. We can ignore the other requirements such as, 'for the purpose of preserving evidence', 'restores', or 'reestablishes' corners of real property because it is how we were taught.

A poll conducted by MSPS in April 2011 asked "Do you feel that the recording of surveys would: Infringe on: *Clients confidentiality?*" Or "*Protect the public?*" [Note: the poll results were nearly 2:1 in favor of protect the public. These results are the same as a similar question in the 2010 poll.] Two-thirds of respondents think the recording of surveys would protect the public.

Even so, one surveyor responded to the question stating, "[the] "public" has no right of disclosure… Their neighbor bore the expense and had the foresight to get a survey". This response seems to be at odds with our Code. 2030-2 simply and clearly states, (3) "… In the performance of professional services, licensees shall be cognizant that their primary responsibility is to the public welfare, and this shall not be compromised by any self-interest of the client or the licensee."

Several more from the one-third minority stated something similar to the following; "The statute [CSR 2030-2] as defined in paragraph 14 "Licensees shall not reveal confidential, proprietary or privileged facts … obtained in a professional capacity without the prior consent of the client or employer except as authorized or required by law or rules of this board." talks about private information. What you own as defined by the public record is a matter of fact… These items are not covered by paragraph 14. This paragraph allows the client to keep private his or her reasons for a survey." It is interesting to note that the writer discusses "facts" as a matter of record evidence, and then wishes to withhold the critical evidence shown on boundary surveys from the public record.

Two other issues are brought to light. The first is; a retracement surveyor, which is every single one of us, is attempting to recover what *has been established, determine what is obliterated and can be restored, or what must be reestablished* on the ground. How is this competently done with unknown, unrecorded surveys "out there", somewhere? The clients "reasons for a survey" are simply not relevant in retracing what a surveyor has established on the ground, or for the public to identify common boundary lines. The second issue is; the premise that it is a private matter for the client and their surveyor. If that were true, then we must ignore our code of professional conduct which clearly states that the clients' interest, and the surveyors' business interests and practices are not superior to our basic and fundamental charge to protect the public.

Missouri's recording requirements have been the subject of numerous articles and have been "cussed and discussed" at length. One of these recoding requirements is presented for your consideration:

> Section 137.185 "Tracts less than one-sixteenth of a section, it shall be the duty of such person… to cause such lands to be surveyed and a plat thereof made by a surveyor" …"Said plat shall be certified to by the surveyor and recorded ..."
> 137.185 clearly states that tracts less than one-sixteenth section shall be surveyed and the survey shall be recorded. It states, the owner shall cause the survey to be conducted and recorded. Some of us have accepted this to mean that it is the owners' responsibility to record the survey. But is that what the statute says? No. This law states, they shall cause it to be surveyed and recorded? Usually, the client or owner has caused the survey to be conducted completely unaware of the requirements of law. They are also completely unaware of the requirement to record. Is it not the professional surveyor who is required to have this 'special knowledge'?

So, let us consider: You are commissioned to perform a survey for a parcel less than one-sixteenth section. The client is unaware of any requirements to record; it is not recorded under other provisions of law or local government regulations, and given that:
A Professional Surveyor is defined as a person whose, 'adequate performance of which involves the special knowledge and application of the principles of the relevant requirements of law that affect real property rights'.

"These rules of professional conduct are binding for every licensee" and their "primary responsibility is to the public welfare." "This shall not be compromised by any self-interest of the client or the licensee", they "shall comply with state laws and regulations governing their practice", and they "shall not knowingly violate these laws".

> Section 60.657 "A survey plat is not required to be filed when: … it has been recorded under any other provision of law."

Are you the professional surveyor required or ethically obligated to record the survey?
Or both!

The Client

by Robert A. Daniels, NSLS, CLS

Any business person will tell you that it is impossible to operate a profitable business without clients. Even governments need clients in order to justify their existence. Professional surveyors who provide services need clients in order to survive. As every business person knows, clients come in all shapes, sizes, dispositions and financial capacities.

As a general statement, in any business there are two types of clients: those who want to purchase your services or product and those who need to purchase your services or product. As we have all told our children or were told by our parents, your wants and needs are two different things. Luckily, professional land surveying services tend to fall in the "need" category

With the best interests of society in mind, various pieces of government legislation make the land surveyor's services a necessity. Without our services, people cannot subdivide or develop land; they cannot build houses or obtain mortgage funds from various lenders. Other respected professions, such as lawyers, engineers and architects, depend on survey services on a daily basis. One interesting attribute of many of the people who need survey services is that they have no idea of what we do or how we do it. All they know is that they need it.

You would assume that, what with having other professionals depend on your services, having your services mandated by legislation, and having a clientele that really doesn't understand what you do, making a good living would be easy! But in far too many instances, land surveyors fall victim to being told what they can charge by their client. Now it doesn't make sense to me that a client who must have your service and doesn't know what you do should have the ability to make any kind of an informed decision about the value of the product and service they will receive or influence fees. This unfortunate state of affairs has come about as a result of too many land surveyors being too quick to reduce their fees for fear of losing a client to a competitor.

Clients who "need" service will always have the financial capacity to pay for that service. They have no choice. Fortunately, clients of land surveyors usually have the most valuable asset of all, land. Other professionals are not so lucky; lawyers sometimes have clients who are destitute and can never pay their bills, architects may have clients who are purely fantasizing about their dream house. When the reality of what it will cost is realized, the dream may disappear along with the architects' chances of collecting for their services. In most cases, the land surveyor's clients have a valuable asset (land) that will enable them to raise the funds necessary to pay the account.

As stated earlier, clients come in all shapes, sizes and dispositions. The shape and size of a client have little to do with their potential to be a good client. However, their disposition can make you regret the day they contacted you.

When you are contacted by a client seeking your services, you can sometimes get a sense of what kind of relationship will result. In most instances, it is a good relationship; the service is provided, it is satisfactory and the client pays the invoice. These are clients worth keeping. To keep good clients, you may sometimes have to give them a little bit of special service to ensure they become return clients.

Sometimes you can sense a problem client at the outset. These people are overly demanding, and do not understand that it takes time and effort to provide the service. They twist what you have told them into interpretations, that are for their benefit and to your detriment. This is a client we can all do without.

Then there are the bargain hunters. They spend a great deal of their time contacting every land surveyor in the yellow pages to get the cheapest price for a service they know nothing about. Often you will know that these people are "shopping" for the best price, because they will tell you. If you expect to make a good living from surveying, you are better off not dealing with these individuals at all. You will spend your time providing a cost estimate; they will shop until they find a cheaper price, and even if you do have them as a client, there it little chance of return or future business.

I have often heard of the 20/80 rule in life. This rule can be applied to business as well. It works like this: 80% of your profit will come from 20% of your client base, and 80% of your business problems will come from 20% of your client base. We could all do without the troublesome 20%.

A couple of basic principles of business to remember are: 1) you do not have to take on all clients that come through the door, and 2) you have a right to expect reasonable compensation for the, expert services you provide. "And that's the bottom line", according to Stone Cold Stew Austin of the WWF.

As seen in Backsights & Foresights. Mr. Daniels is a surveyor in private practice with over thirty years of experience. He is a Past President of the Association of Nova Scotia Land Surveyors and was also the Executive Director for five years.

As seen in "Section Lines," Kansas, November 2011

Letter to the Editor

Dr. Richard Elgin, PS, PE

Dear Editor,

I have recently been reading a batch of Missouri appellate court cases relative to boundaries. The reports of decisions in these cases are some of the most boring, verbose, laborious, tedious and dull reading known to man (or woman). Occasionally one of the judges interjects something into a case report which is refreshing and brings a smile to the reader. Such is the case (no pun intended) in Burke v. Colley (495 SW2d 699, 1973). Part of the case was a riparian boundary issue. From the decision:

> "… plaintiffs and defendants are neighbors with their respective farms being located in Ripley County. And it is the cool, clear and sparkling waters of many a float fisherman's fondest memory, the Current River, and its rise and fall over the years, which has given rise the present controversy….Current River begins its 250 mile southerly sojourn in Texas County, Missouri, and empties into the Black River in Randolph County Arkansas….As it traverses the Missouri Ozarks and winds its way toward the Land of Opportunity it passes through the County of Ripley where a sign located on the courthouse lawn in Doniphan proudly proclaims to the world: "Ripley County–Where History Is Preserved and Nature Stands Revealed."
>
> "The writer can attest to the validity of this claim having judicially observed pigeons flying through opened windows into the high ceiling courtroom during the course of a trial. Aside from the obvious distraction, this caused court personnel, jury and spectators some understandable concern. And 'nature' was suddenly revealed on the 35th Judicial Circuit Court Reporter's stenotype carrying case before the pigeons were ousted by judicial edict-and sheriff's deputies. On another occasion a wasp caused a sudden recess when it decided to explore the anatomy of the 35th Judicial Circuit Court Reporter via his pants leg."

Ah, the nature of Ripley County!

Dick Elgin, PS
Archer-Elgin Surveying and Engineering, LLC
310 E. 6th Street
Rolla, MO 65401

MO Colleges/Universities Where Land Surveying Coursework is Available

The following list will be updated quarterly as new information becomes available.

Longview Community College — Lee's Summit, Missouri
Contact: David Gann, PLS, Program Coordinator/Instructor — Land Surveying MCC — Longview, MEP Division
Longview Community College
Science and Technology Bldg.
500 SW Longview Road
Lee's Summit, Missouri 64081-2105
816-672-2336; Fax 816-672-2034; Cell 816-803-9179

Florissant Community College — St. Louis, Missouri
Contact: Ashok Agrawal
Florissant Community College
3400 Pershall Road
St. Louis, Missouri 63135
314-595-4535

Missouri State University — Springfield, Missouri
Contact: Thomas G. Plymate
Southwest Missouri State University
901 So. National
Springfield, Missouri 65804-0089
417-836-5800

Mineral Area College — Flat River, Missouri
Contact: Jim Hrouda
Mineral Area College
P.O. Box 1000
Park Hills, Missouri 63601
573-431-4593, ext. 309

Missouri Western State University — St. Joseph, Missouri
Contact: Department of Engineering Technology
Missouri Western State University
Wilson Hall 193
4525 Downs Drive
St. Joseph, MO 64507
816-271-5820
www.missouriwestern.edu/EngTech/

St. Louis Community College at Florissant Valley
Contact: Norman R. Brown
St. Louis Community College at Florissant Valley
3400 Pershall Road
St. Louis, Missouri 63135-1499
314-595-4306

Three Rivers Communitiy College — Poplar Bluff, Missouri
Contact: Larry Kimbrow, Associate Dean
Ron Rains, Faculty
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2080 Three Rivers Blvd.
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University of Missouri-Columbia, Missouri
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573-882-4377

Missouri Southern State College — Joplin, Missouri
Contact: Dr. Tia Strait
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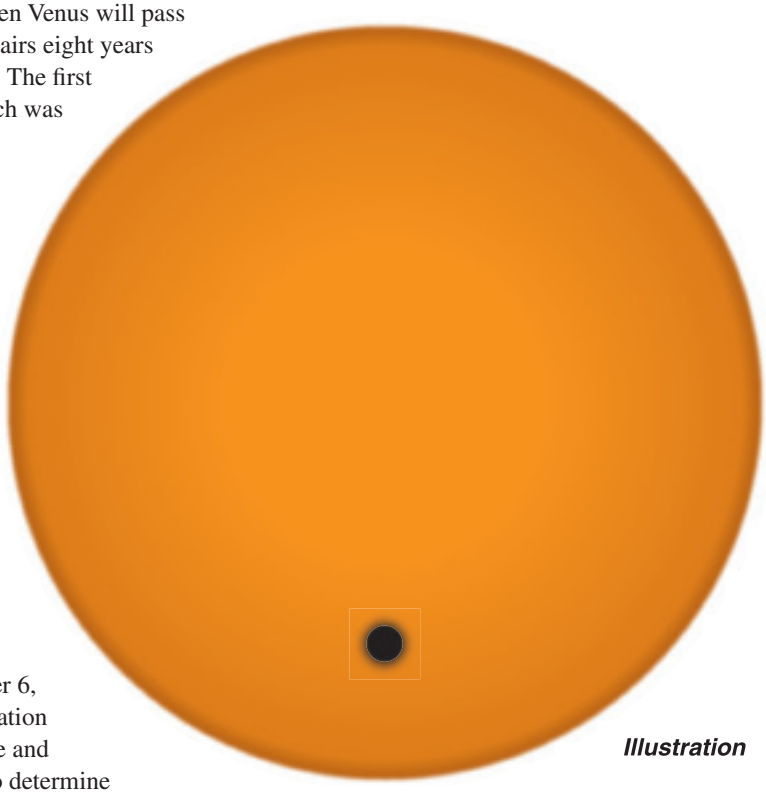
3950 E. Newman Rd.
Joplin, MO 64801-1595
1-800-606-MSSC or 1-417-782-MSSC

The June 2012 Transit of Venus

by Joe Senne, P.E. Rolla, Missouri

On June 5, 2012 North America will be witness to a rare event when Venus will pass (transit) in front of the Sun's disk. These transits, which occur in pairs eight years apart, were first predicted by Johannes Kepler in the 17th century. The first documented observation was the transit of December 4, 1639 which was observed in England.



Illustration

Once this phenomena was established, astronomers realized that observations from different locations on Earth could be used to calculate the elusive Astronomical Unit (AU) which is defined as the mean distance between the Earth and Sun. Previous observations of the planets and Newton's law of gravitation established the relative size of the Solar System but the true size required a known measurement. It was determined that the timing of the contacts that Venus made with the Sun could be used to calculate the AU. Astronomers prepared for the next opportunity which came on June 6, 1761 and June 3, 1769. Europe dispatched expeditions to the far corners of the Earth to time the events. Results were mixed because the technology of the time was poor and atmospheric conditions (the "black drop" problem) made for errors.

The next pair of transits occurred December 9, 1874 and December 6, 1882 which gave an opportunity for more attempts. The determination of the AU took on the character of the Harrison clock for longitude and the modern day space race where each nation vied to be the first to determine this elusive distance. Again expeditions were launched using better technology including better solar telescopes, clocks, and now photography. Again results were mixed and did little to improve the AU. Several years later near Earth asteroids were discovered. They, along with space probes, have provided a much more accurate way to calculate the AU which presently stands equal to 149,597,870.7km or 92,955,807US statute miles. Interesting for their rarity, transits now have little scientific value.

For those in Missouri the June 5 transit will begin at about 5:04:30pm CDT when Venus's image makes first contact with the Sun's disk. At 5:22:15pm the image will just be inside the Sun's disk. These times will vary a few seconds depending on your location in Missouri. The Sun will be due West at 36 deg. altitude and sets at 8:26pm right near mid transit. So Missourians will not see the entire spectacle. You would have to go to Hawaii or the central Pacific area to see the whole event which lasts about six and one half hours. In Europe only the last part of the transit will be visible after sunrise on June 6.

If you have a total station or surveyor's transit to use, this would be a good time to dust off your old solar filter to observe this event. If you don't have a filter a #12 or # 14 welders glass can be purchased for a few dollars at any welders supply store. If you have good vision you should be able to barely see the transit without a telescope. REMEMBER don't look at the Sun without a filter.

And if you miss this opportunity, or get clouded out, you will have to wait 105 years or until December 11, 2117 to see the next episode.

Seven marketing tips to help you through a downturn

Practical advice for challenging times. For any size firm.

by Paul Fahey Reprinted from *Empire State Surveyor*, Vol. 47, No. 2, March/April 2011

This won't be the first article reminding you that these are tough economic times. We're all aware that project volume has dropped off. Project budgets seem to be smaller than we've enjoyed in recent years. And chances are you've lost a few clients along the way. But I hope this will be among the few that offer practical marketing advice to help you avoid damage from the downturn. And if you're not experiencing these problems, good for you. But keep reading. There's practical advice here for you, too.

As a Land Surveyor, you're accustomed to reaching for the right tool for the job. Ground penetrating radar. GPS Data-Collectors. Laser Levels. The good news is that you already have the right tools to help you during this recession, too. They just might need a little focus and sharpening.

Let me be clear, marketing is not advertising. And marketing will not help you avoid a downturn. There are many forces that are simply beyond our control. But a smart approach to marketing can help you avoid damage from a downturn. Okay, now that we're on the same page, let's get started.

1. Audit Your Best Clients First. The goal here is to identify the best qualities about these relationships (including marketing) and repeat them. Resist the temptation to jump in and start advertising, create a Facebook page or increase the size of your yellow page ad. Take a step back and think about your clients. Not just all of your clients, but your best ones. Whatever that definition is to you. This doesn't have to be a formal process. A cocktail napkin will do nicely. Or, even better, take them to lunch and ask them these questions directly. It's a great relationship-building moment (and is partially tax-deductible!) What makes them profitable or simply enjoyable to work with? What services do you provide to them? Do you know why they value your services? How did you acquire them as a client? What sectors are they in? If you're lucky, trends will emerge after you've thought about a few clients. These trends should inform your future marketing efforts.

2. Audit Yourself Second. It's nice to say your company can do anything. And, during a downturn, it's tempting to diversify yourself to create more opportunities for income. These days, I see many companies grabbing up work they may not be totally qualified to do. Or even reaching down for projects that normally would be too small. But, for long-term survival, it's better to concentrate on what you do best. Focus on the services and experiences where you and your company stand out. Understand what you do best and focus on those opportunities and avoid chasing everything that comes your way.

3. Leverage Your Experience. Your marketing should dive deeper than a list of services into something that sounds more like storytelling. Think about the projects you've done that really stood out in your career. What made them special? The impossible deadline? The technology challenge? A major obstacle overcome by your creative thinking? Elaborate on your previous related experience and pack these into case studies (with photos) that you include on your web site, in proposals and even in your conversation with prospects. When they ask about what you do, give them a story, not just a list. Don't forget the awards and recommendations from highly regarded sources that support the quality of your services. Emphasize the unique capabilities that your company can provide and how your company would be a valuable asset to them.

4. Focus. First, decide if you should focus on a particular industry, company size, or niche. Then focus on a few target companies or agencies that your company capabilities best support. Focus on the companies that meet your short and long term goals: cash flow, entering a new market, strengthening your position in a particular sector, etc.

5. Support Your Marketing With the Right Promotion. Advertising is rarely the best first option but because it's quick and simple, people tend to think of that first. Think back to your client audit. How did you acquire those clients? The business of land surveying is very relationship-driven. So, it won't surprise me if you acquired many of these clients through referrals or word of mouth, Consider events and meetings attended by your target audience, supported by direct marketing (print or email) to prospects and referral sources. And don't forget the benefits of being a member of the New Your State Association of

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Seven marketing tips to help you through a downturn

(continued from page 12)

Professional Land Surveyors. Their seminars and networking events have been invaluable to many members looking to expand their businesses.

6. Consider the Value of Outside Expertise. There's a lot you can do with your in-house team, but chances are you're spread thin these days. The value of having a marketing firm do some of this research for you is kind of like the value an association gives its members. The NYSAPLS are "hired" by your dues dollars to:

• conduct research on your behalf

• create educational opportunities to help you retain your license

• legislate on your behalf to keep your profession intact and forward thinking

• offer web advertising and web awareness to help attract new clients

• create content that will help you educate your clients on your role and value

Hiring a marketing firm to do that business planning and market research that a business owner doesn't have the time to do can really add value. A good firm can help you with each of these steps and get you started, then step away when you're rolling along.

7. First Impressions are Lasting Impressions. Project a professional image, from the first telephone call to the content and appearance of your company's web site, brochures and trade show booth. Home-grown materials are great for start-ups, but if you want to compete with credibility, you have to look professional. Consider an investment in professional design.

So, there you have it. Seven practical tips that you can put into action today. I hope the advice in this article will sharpen your marketing tools to improve your chances of avoiding damage from this downturn.

Paul Fahey is the COO and Director of Marketing Strategy at Zone5, a national marketing firm based in Albany, NY whose clients have specialized in the design professions. He can be reached at 518-242-7026 or paul.fahey@zone5.com

National Museum of Surveying

It's Show Time!

Dear Friend of the Museum,

It is finally here! After many months, our movie is finally here. After weeks of shooting, months of editing, and then political musical chairs in Springfield forcing us to change our opening, we finally got the movie done. The movie is a brief five minute virtual tour of the museum. Please share it with anyone and everyone. Feel free to take it off the internet and make copies. Most of all, enjoy the museum. We can provide physical DVDs (at a cost) for anyone who wants one.

The movie was mostly volunteer. The editing was done at cost. Other than that, everyone in front of the lens and behind the camera, lights, and sound were volunteer. A big thanks goes to them.

Managing Employee Benefits In Difficult Economic Times

A mini-white paper focusing on how some employee benefit programs are currently being handled

INTRODUCTION

The decades-long trend of high and rising healthcare costs has given way to an even tighter crunch for employers and employees alike during this current economic downturn. Employers have been forced to initiate cost-cutting measures while reducing, and in some cases eliminating, employee benefit packages. Some employers are drastically reducing benefit packages for a determined amount of time. Others are cutting back, but maintaining a balance between employee retention and implementing cost control measures.

One thing seems clear through our lens — controlling benefit costs is a primary objective for most employers. This represents a troubling trend, coming at a time when workplace productivity has come to the core as yet another primary objective of an employee benefits program.

Indeed, several new approaches for optimizing workplace productivity have emerged, and all of them revolve around having a much greater degree of employee involvement as a general costcutting measure. What many employee benefit managers are discovering is that a combination of increased employee involvement and engagement, the active management of chronic conditions and improved health and wellness are extremely effective tools and tactics for cost reduction. The main goal of these new approaches is to reduce health care benefit program costs and improve the overall productivity of the workforce, at the same time.

One of the latest cost-cutting techniques that are being utilized by employee benefit managers is the formation of employee benefit coalitions. These entities are not entirely new, but the combination of decades of rising healthcare costs, coupled with a severe, prolonged economic downturn, have given them new life. Even large corporations are turning to these coalitions in an effort to cut costs.

CONTROLLING BENEFIT COSTS

According to MetLife's 9th annual Study of Employee Benefits Trends*, employees now consider workplace benefits to be the foundation of their personal financial safety net. In fact, as the report further points out, they indicate that health benefits are nearly as important as salary in determining their feelings of loyalty toward their employer.

The study also evaluates employer objectives with regard to benefits. Employers consider benefits to be an important tool for retaining employees and increasing productivity. But just as importantly, they want to be able to control costs.

As mentioned briefly in the introduction, one particular way employers are cutting costs is by using employee benefit coalition purchasing alliances to leverage market power. These modern-day coalitions are bringing classic group buying power theory into the 21st century, and the reasons behind their growing popularity is that the savings they generate can be substantial.

In the past, group buying was widely ignored, as many large and mid-sized employers were confident in their vendors' ability to provide a good value. But recent upward trends in health care spending have triggered renewed interest in coalitions. Even the largest employers can produce gains they couldn't realize on their own. Interest, in fact, has broadened as coalitions previously available only to larger employers with significant employee populations are now open to smaller groups.

For employee benefit managers, the last three decades have produced an almost total revamping of the compliance laws and regulations, impacting every major administrative area. Such changes touch everything from plan creation to tax qualification, governance, trust and fiduciary responsibility, documentation, reporting, disclosure, provider contracts, and claims and appeals. But while these changes have often been brought about to clarify operational guidelines, they have also challenged the ability of companies striving to stay abreast of new rules. Weighing the practical implications of new laws and assessing their impact on annual vendor agreements can take time and added deliberation. Thus, for the individual benefit manager, huddling with industry colleagues to plot a common course in the face of dramatic changes brought about by the Medicare Drug Act, HSAs, ERISA, cafeteria plan regulations, and HIPAA, for example, can represent immeasurable value. In addition, many coalition members are drawn to purchase groups for their ability to influence legislation and regulatory guidance.

The 9th Annual MetLife Study of Employee Benefit Trends was conducted during the 4th quarter of 2010 and consisted of two distinct studies fielded by GfK Custom Research North America. The employer survey comprised 1,508 interviews with benefits decision-makers at companies with staff sizes of at least two employees. The employee sample comprised 1,412 interviews with fulltime employees age 21 and over, at companies with a minimum of two employees.

(continued on page 29)

Missouri Society of Professional Surveyors
Spring Workshop
The Lodge of Four Seasons, Lake Ozark, MO
May 11-12, 2012

Everything Surveyors need to know about Realtors, Title Companies and Client Communications

Missouri Society of Professional Surveyors
722 E. Capitol Avenue, PO Box 1342
Jefferson City, MO 65102
573-635-9446
Fax: 573-635-7823
Email: msps@missourisurveyor.org
Www.missourisurveyor.org

Thursday, May 10, 2012

12:30 p.m. — Golf Tournament Fundraiser at The Cove Golf Course - Shotgun Start

6:00 - 8:00 p.m. — Exhibitor Set-Up

Friday, May 11, 2012

What has the economy done to your business?

7:00 a.m. — Registration and View Exhibitors with Continental Breakfast

8:00-9:30 a.m. — Realtors
Speakers: Rhonda Overberg, ReMax Best Choice and Stacy Shore, Lake Ozark ReMax
What changes in laws have affected your business? How has your business changed because of lawyers? The difference between buyers and sellers? What costs are involved with realtors?

9:30-10:00 a.m. — Break to View Exhibits

10:00-11:00 a.m. — Surveyor
Speaker: Don Bormann
New laws and rules affecting your business.

11:00-12:00 noon — Title Company
Speaker: John Teale & Michael Freeman
What laws have changed your business? Explain types of policies - lenders, buyers, etc.. Why can't we get an abstract? How do you perform your research? How can surveyors and title companies work together more efficiently?

12:00- 1:30 p.m. — Lunch and View Exhibits

1:30 – 2:00 p.m. — Title Company ***continued***

2:00 – 3:30 p.m. — Recorder of Deeds
Speaker: Bettie Johnson, Boone County Recorder
New laws and technologies affecting recording.. Working with the Land Surveyor, Counties and Cities for recording restrictions.

3:30 – 4:00 p.m. — Break to View Exhibits

4:00 - 5:30 p.m. — Panel Discussion
Moderator: Larry Phipps
Realtor, Title Company, Surveyor, and Recorder
What is a typical survey request? What is supplied along with a title report? What does the surveyor need and how is it used? What are the expected results?

5:30 p.m. — Reception with Exhibitors

Saturday, May 12, 2012

7:00 am — Registration and View Exhibits with Continental Breakfast

8:00 a.m. - 12:00 Noon — Preparation & Presentation - Effective Client Communications
Speaker: Larry Phipps
As a professional land surveyor, the most important part of your job is also probably the part we pay attention to the least. We all spend time doing thorough research, making carefully planned measurements, and reaching well reasoned - insightful conclusions. As import as all those things are, they mean little or nothing unless we are able to appropriately communicate their meaning to our clients. That is why this topic is so important. We won't limit the discussion to drawing plats or writing legal descriptions. As important as they are, they are only the tip of a very big iceberg. Client communication covers everything from the non-verbal (how you dress, the look of your business card, or the location of your office) to how you go about getting the client in the first place. We will discuss communication in all it's many forms and how we as professionals have special obligations that come with our license.

12:00 - 1:00 p.m. — Lunch

1:00 - 5:15 p.m. — Preparation & Presentation ***continued***

Registration Information:

Registration fee is $175 for MSPS Members and $300 for Non-Members. Deadline for registration is April 25, 2012. After this date, a 10% processing fee will be added to registration fees. The fee includes instructional materials, refreshment breaks, luncheon on both days, cocktail reception and two continental breakfasts. To register, complete the attached form and mail it with your check to MSPS, 722 E. Capitol Avenue, PO Box 1342, Jefferson City, MO 65102. For more information on this course, call Sandra Boeckman at 573-635-9446.

Special Rate for Technicians:

A special rate of $150 is available for non-licensed technicians (Associate Members of MSPS). Registration fee plus 2012 Associate Membership is $185. Call MSPS for details at 573-635-9446.

Golf Tournament (Scholarship Fundraiser):

Register to play in the Golf Tournament Fundraiser for the MSPS Scholarship Fund to be held at The Cove Golf Course, The Lodge of Four Seasons beginning at 12:30 p.m. The cost is $85 per person which includes two mulligans per player.

Location and Lodging:

The Lodge of Four Seasons in Lake Ozark is the location for the 2012 Spring Workshop. A block of rooms has been reserved at the Lodge at a rate of $99.00 for single or double occupancy. Deadline for reservation is April 10, 2012. Make your reservation by calling the Lodge of Four Seasons at 888-265-5500.

Cancellation Policy:

MSPS reserves the right to cancel the program and return all fees in the event of insufficient registration. A participant may cancel a registration up to two weeks before the course date and receive a full refund. **NO REFUNDS AFTER APRIL 25, 2012.**

Continued Education Credits:

This course has been approved for 15 PDUs or 15 hours of continuing education (7.5 each day) by the Missouri Board for Architects, Professional Engineers, Professional Land Surveyors and Landscape Architects.

Registration Fees:

❒	MSPS Members	$175.00
❒	Non-Members	$300.00
❒	Technician (Associate Member)	$150.00
❒	Techs + Associate Membership	$185.00
❒	Golf (per person)	$85.00

Conference Registration

Name: _____ PLS #: _____

Firm: _____

Address: _____

City, State: _____ Zip: _____

Phone: _____ Fax: _____

Email: _____

Payment Options

___ Visa ___ Mastercard ___ Discover

Card #: _____ Exp. Date: _____

Total Amount: $_____

___ Check Enclosed ___ Invoice my Firm

Make checks payable to MSPS - advanced registration is necessary and appreciated!

To register, detach and mail to:

MSPS, PO Box 1342, Jefferson City, MO 65102

Phone: 573-635-9446, Fax: 573-635-7823, Email: msps@missourisurveyor.org

Registration Deadline is April 25, 2012

Missouri Society of Professional Surveyors
722 E. Capitol Avenue, PO Box 1342
Jefferson City, MO 65102
Www.missourisurveyor.org

About the Speakers

Rhonda Overberg was first licensed in Real Estate in 1987. She consistently maintained one of the top sales positions in the area on her own. In 1993 when her husband joined her they continued to sell Real Estate together eventually building a larger team. In 2001 they opened their first RE/MAX franchise and then later in 2003 purchased an existing franchise in Festus and changed it to RE/MAX Best Choice, in 2006 they built and opened their third Franchise in St. Louis. In 2008 they decided to move their first Franchise to Farmington in a separate market since it was in the backdoor of the existing Festus location. They structured their company to cover several counties. In September of 2011 they reopened their first location with a Team Branch for the Overberg team. They look forward to bringing the team to this location and opening up space to grow their company at their Festus location. Although they have only 61 agents their company consistently ranks in the top 20 in the St. Louis mls each year, (the St. Louis mls contains more than 1600 offices). Their agents are among the very best and most productive agents and are supported by a National Franchise RE/MAX second to none for training, advertising and support.

Bettie Johnson has served Boone County, Missouri, as Recorder of Deeds since 1979. Prior to being elected, she worked in the title industry. She has been active in the Recorders Association of Missouri serving all positions on the board and continues as Legislative Co-Chair. Bettie is a member of the International Association of Clerks, Recorders, Election Officials and Treasurers (IACREOT) serving on numerous committees and as President in 2006. She has also served on the Property Records Industry Association (PRIA) Executive Board as Secretary and Vice President, Real Property Law Committee Co-Chair, and on the XML Electronic Recording Workgroup. In addition, she has served on a number of local and state boards and committees, including the County Employees Retirement Fund for the State of Missouri and the Missouri Housing Alliance Industry.

Stacy Shore has been a realtor at the Lake of the Ozarks for 16 years. She is consistently recognized as a multi million dollar producer and part of the top producers within the Re-Max organization. She graduated from MSU with dual majors in Political Science and Public Administration. She is currently on the Board of Directors of the ARC of the Lake, a member of the Lake of the Ozarks Board of Realtors Water Quality Task Force and a board member of the Laker ABC. She has also authored a website to inform LOZ Stakeholders on the fight against the Federal Government for private property rights. She is a watchdog group advocate and an active member of the Lake Area Conservative Club at the Lake.

John Teale is the co-founder and President of Midland GIS Solutions (2000-Present). He was President of Midland Surveying (formerly Midland Engineering) from 1989-2006 and currently serves as Executive Vice-President. He is also President of Nodaway County Abstract & Title Company (formerly Allen & Quinn Abstracting) from 1992-present. John is a Professional Land Surveyor licensed in Missouri, Iowa, Nebraska and Kansas and is a Licensed Title Agent in the State of Missouri. He received his B.S. degree from Northwest Missouri State University in 1973 and was appointed to the Missouri Board of Architects, Professional Engineers, and Professional Land Surveyors and Landscape Architects in 2006.

Michael Freeman is the owner and principal of Bentley Title Co. a land abstract business in Hickory County that has been in continuous operation since 1887. Mr. Freeman holds degrees in both Business Administration and Accounting from Drury University. Michael has been a licensed Title Insurance Agent since 1980. In 1987 his interest in surveying allowed him to obtain additional education in both surveying and soil science and actively pursue a career path to Surveying registration. In 1988 he was elected Hickory County Surveyor, a post he held until 2008. In 2007 Michael was appointed to the Survey Division of the State Board for Architects, Professional Engineers, Professional Land Surveyors and Landscape Architects. In 2010 he was selected as Chairman of the Survey Division.

Don Bormann graduated from the University of Missouri-Columbia with BS degrees in Agriculture and Engineering. He has been a registered land surveyor for 30 years working in land surveying and construction staking. He has been the owner/operator of Bormann Surveying for over 22 years. In the mid 1990's, he taught land surveying courses at Columbia College in Columbia, Missouri. Don has been involved with survey legislation for most of the last 30 years and is also on the standards committee. He has been on the Centralia Planning and Zoning Commission for 4 years and an alderman in Centralia for 3 years.

Larry Phipps is a Professional Land Surveyor with years of experience and a national reputation as a First Class Surveying Instructor. In the past 10 years his travels have taken him to more than 30 States and 4 foreign countries. In addition to teaching, he owns and operates a small surveying company in the mountains of North Carolina. He is a 1980 graduate of North Carolina State University. While there he obtained degrees in both Forestry and Wildlife Biology. Since that time he has held leadership positions in many community organizations including stints as President of the Ashe County Chamber of Commerce, and the Ashe Economic Development Council. He is also a founding board member of the Ashe Youth Connection.

Missouri Society of Professional Surveyors

Surveyors Review Course
August 15-17, 2012
Best Western Capital Inn, Jefferson City

PROGRAM

Wednesday, August 15
1:00-5:00 pm and an evening session
Surveying Math

Calculator Use, Basic algebra, trigonometry and geometry,
Traverse calculations and coordinate geometry, Surveying math applications
(Bring your NCEES-approved calculator)

Thursday, August 16
8:00 am-5:00 pm and an evening session
Surveying Fundamentals

Errors analysis, State plane coordinates
Route surveys, GPS & GIS
Exam preparation, Legal principles and definitions

This course is appropriate for those who will be taking any part of the surveying licensing exams, or for those already licensed and wish to review surveying topics and receive PDUs.

Friday, August 17
8:00 am-3:30 pm
Missouri Practice

Missouri Minimum Standards and Board Rules
Missouri GLO system, Resurveys on Missouri's GLO system (RSMO Chapter 60)
Other Missouri Statutes, Riparian Boundaries

COURSE INSTRUCTORS are Dr. Joseph Paiva, PLS, Dr. Dick Elgin, PLS, PE and Mike Flowers, PLS — All are well known surveying professionals. Joe Paiva helped found the Review Course and for years all three have previously taught parts of it. Joe is a geomatics and business development consultant to surveying instrument manufacturers. Dick Elgin works for Archer-Elgin Surveying and Engineering, LLC (Rolla). Mike Flowers is the former Missouri State Land Surveyor. Mike is a member of the Missouri Board for Architects, Professional Engineers, Professional Surveyors and Landscape Architects.

Missouri Society of Professional Surveyors
Est. 1957

This course has been approved for continuing education credits from the Missouri Board for Architects, Professional Engineers, Professional Land Surveyors and Landscape Architects for the following hours:
Wednesday — 6.0 PDUs
Thursday — 9.5 PDUs
Friday — 6.5 PDUs

Fee Schedule:

(Multi Day Discounts Available)	MSPS Member	Non-MSPS Member
Wednesday and either Thursday or Friday	$600	$600
Thursday and Friday	$750	$800
All Three Days	$900	$1,000
Wednesday Only	$250	$250
Thursday Only	$500	$500
Friday Only	$450	$450

Missouri Society of Professional Surveyors

Surveyor's Review Course

August 15-17, 2012

Best Western Capital Inn

Jefferson City, MO

Location and Lodging:

A block of rooms has been reserved at the Best Western Capital Inn in Jefferson City, Missouri, at a rate of $87.30 for single or double occupancy which includes a Full Hot Breakfast. **Deadline for reservation is August 1, 2012.** Make your reservation by calling 573-635-4175.

Cancellation Policy:

MSPS reserve the right to cancel the program and return all fees in the event of insufficient registration. A participant may cancel a registration up to two weeks before the course date and receive a full refund. **NO REFUNDS AFTER August 1, 2012.**

Review Course Registration

Review Course Fees: *(please check appropriate box (es)*	MSPS Member	Non-MSPS Member
☐ Wednesday and either Thursday or Friday	$600	$600
☐ Thursday and Friday	$750	$800
☐ All Three Days	$900	$1,000
☐ Wednesday Only	$250	$250
☐ Thursday Only	$500	$500
☐ Friday Only	$450	$450

To register, detach and mail to: **MSPS, PO Box 1342, Jefferson City, MO 65102**
Phone: 573/635-9446 Fax: 573/635-7823 Email: msps@missourisurveyor.org

Registration Deadline: August 1, 2012

Name: _____

Firm: _____

Address: _____

City, State, Zip: _____

Office Phone: _____ Fax: _____

RLS No: _____ Email: _____

☐ Mastercard ☐ Visa ☐ Discover

Credit Card

Make checks payable to MSPS
Advanced registration is necessary and appreciated.

Card Number: _____

Signature: _____

Total Amount: _____

Some Recent Advances in GPS – Precise Point Positioning

by Mohamed Elsobeiey and Ahmed El-Rabbany, Department of Civil Engineering (Geomatics Option), Ryerson Univerity, Reprinted from *Ontario Professional Surveyor*, Summer 2011

Abstract

Global Positioning System (GPS) surveying has traditionally been carried out in the relative (differential) positioning mode. This is mainly due to the higher positioning accuracy obtained with relative positioning in comparison with point, or standalone, GPS positioning. A major disadvantage of GPS relative positioning, however, is its dependency on the measurements or corrections from a reference receiver or network; i.e. two or more GPS receivers are required to carry out the job. New developments in GPS positioning show that a user with a standalone GPS receiver can obtain positioning accuracy comparable to that of relative positioning. Such technique is known as precise point positioning (PPP).

A major drawback of PPP, however, is that about 30 minutes or more is currently required to achieve centimetre- to decimetre-level accuracy. This relatively long convergence time results from remaining un-modelled GPS residual errors. This article discusses some recent developments in PPP, which are carried out by the Global Navigation Satellite System (GNSS) research group at Ryerson University.

Introduction

Differential carrier-phased-based GPS techniques have traditionally been used in high-accuracy surveying applications. These techniques inherit their high accuracy from the fact that GPS receivers in close proximity share, to a high degree of similarity, the same errors and biases. The shorter the receiver separation is, the more similar the errors and biases. As such, for those receivers, a major part of the GPS error budget can simply be removed by combining their GPS observables. Unfortunately, as the baseline length increases, the errors at the reference and the rover receivers become less correlated; i.e., they would not cancel out sufficiently through differencing. This leads to unsuccessful fixing for the ambiguity parameters, which in turn deteriorates the positioning accuracy. In addition, a major disadvantage of differential techniques is their dependency on the measurements or corrections from a reference receiver or network (e.g., virtual reference station). This, however, may not be a practical solution in many cases, as a result of, for example, high cost or lack of infrastructure.

With the termination of selective availability (SA) in May 2000 and the production of precise ephemeris and clock data through, e.g., International GNSS Service (IGS), it became evident that centimetre to decimetre positioning accuracy is possible with standalone geodetic-grade GPS receivers. Such technique is commonly known as precise point positioning (PPP). Unlike classical GPS point positioning, PPP attempts to account for all the GPS errors and biases (see El-Rabbany, 2006 for details). In addition to being cost effective, the PPP method provides an accuracy level comparable to that of differential carrier-phase-based positioning (i.e., centimetre- to decimetre-level accuracy).

Typically, in PPP ionosphere-free linear combination of undifferenced code and carrier-phase observations is used to remove the first-order ionospheric effect. This linear combination, however, leaves a residual ionospheric delay component of up to a few centimetres representing higher-order ionospheric terms (Hoque and Jakowski, 2007, 2008). Satellite orbit and satellite clock errors can be accounted for using the IGS precise orbit and clock products. Receiver clock error can be estimated as one of the unknown parameters. Effect of ocean loading, Earth tide, carrier-phase windup, sagnac, relativity, and satellite and receiver antenna phase-center variations can sufficiently be modeled or calibrated. Tropospheric delay can be accounted for using empirical models (e.g. Saastamoinen or Hopfield models) or by using tropospheric corrections derived from regional GPS networks such as the National Oceanic and Atmospheric Administration (NOAA) tropospheric corrections (NOAATrop). The NOAATrop model incorporates GPS observations into numerical weather prediction (NWP) models (Gutman et al., 2003).

At present, the IGS precise orbit and clock products do not take the second-order ionospheric delay into consideration. This leaves a residual error component, which is expected to slow down the convergence time and deteriorate the PPP solution. To overcome this problem, higher order ionospheric delay corrections must be considered when estimating the precise orbit and clock corrections and when forming the PPP mathematical model. In this article we restrict our discussion to the second-order ionospheric delay, which is much higher than all remaining higher order terms (Lutz et al., 2010). This article estimates the second-order ionospheric delay and studies its impact on the accuracy of the estimated GPS satellite orbit, satellite clock corrections, and global ionospheric maps. In addition, the effect of accounting for the second-order ionospheric delay on the PPP solution is examined. It is shown that neglecting the second-order ionospheric delay introduces an error of up to 2 cm in the GPS satellite orbit and clock corrections, based on recent (May 5, 2010) ionospheric and geomagnetic activities. In addition, accounting for the second-order ionospheric delay improves the PPP convergence time by about 15% and the accuracy of the estimated parameters by up to 3 mm.

To further improve the PPP solution convergence, we developed a modified PPP model which uses between-satellite single difference code and carrier-phase measurements. The advantage of this model is that, with the exception of multipath and system noise, all receiver-originating errors and biases we cancelled out. This includes receiver clock error, initial phase bias, and others. Our results indicate that the PPP solution convergence is improved by up to 50% in comparison with the undifferenced PPP model. This is

very encouraging as it reduces the station occupation time by up to 50% and is considered a major step towards real-time PPP

Second-order ionospheric delay

The second-order ionospheric delay results from the interaction of the ionosphere and the magnetic field of the Earth (Hoque and Jakowski, 2008). It depends on the slant total electron content (STEC), magnetic field parameters at the ionospheric pierce point, and the angle between the magnetic field and the direction of signal propagation (Figure 1). STEC values may be obtained from agencies such as the IGS and NOAA. IGS produces global ionospheric maps (GIMs) in the ionospheric exchange (IONEX) format. GIMs are produced with a 2-hour temporal resolution and a 2.5° (latitude) by 5° (longitude) spatial resolution on a daily basis as rapid global maps. NOAA, on the other hand, produces a regional ionospheric model known as the United States total electron content (US-TEC). US-TEC covers regions across the continental US (CONUS), extending from latitude 10° to 60° North and from longitude 50° to 150° West. The USTEC maps have a spatial resolution of 1°x1° and a temporal resolution of 15 minutes (Rowell, 2005). The maps include both STEC and vertical total electron content (VTEC) for different locations and directions. Alternatively, STEC can be estimated by forming the geometry-free linear combination of GPS pseudorange observables and applying the receiver differential code biases.

The geomagnetic field of the Earth can be approximated by a magnetic dipole placed at the Earth's centre and tilted 11.5° with respect to the axis of rotation. The magnetic field inclination is downwards throughout most of the northern hemisphere and upwards throughout most of the southern hemisphere. A line that passes through the centre of the Earth along the dipole axis intersects the surface of the Earth at two points, referred to as the geomagnetic poles.

A more realistic model for the Earth's geomagnetic field, which is used in this article, is the international geomagnetic reference field (IGRF). The IGRF model is a standard spherical harmonic representation of the Earth's main field. The model is updated every 5 years. The International Association of Geomagnetism and Astronomy (IAGA) has released the 11th generation of the IGRF in December 2009. The coefficients of the IGRFII model are based on data collected from different sources, including geomagnetic measurements from observatories, ships, aircrafts, and satellites (NOAA, 2011), The relative difference between the dipole and IGRF models ranges from -20% in the east of Asia up to +60% in the so-called south Atlantic anomaly (Hernández-Pajares et al., 2007).

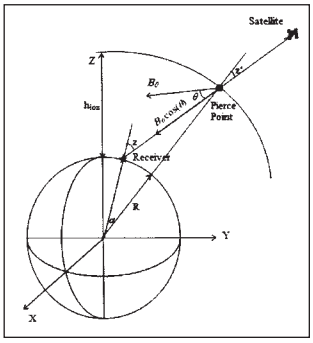

Figure 1. Magnetic Field and Propagation Direction

Effect of second-order ionospheric delay on satellite orbit and clock corrections

To investigate the effect of second-order ionospheric delay on the GPS satellite orbit and clock corrections, Bernese GPS software was used. A well-distributed global cluster of 284 IGS reference stations was formed based on a priori information about the behavior of each receiver's clock and the total number of carrier-phase ambiguities in the corresponding observation files. GPS measurements collected at the 284 IGS stations were downloaded from the IGS website for May 05, 2010 (DOY125). The raw data were first corrected for the effect of second-order ionospheric delay. The corrected data along with the broadcast ephemeris were used as input to the Bernese GPS software to estimate the satellite orbit and clock corrections. Our study shows that the effect of second-order ionospheric delay

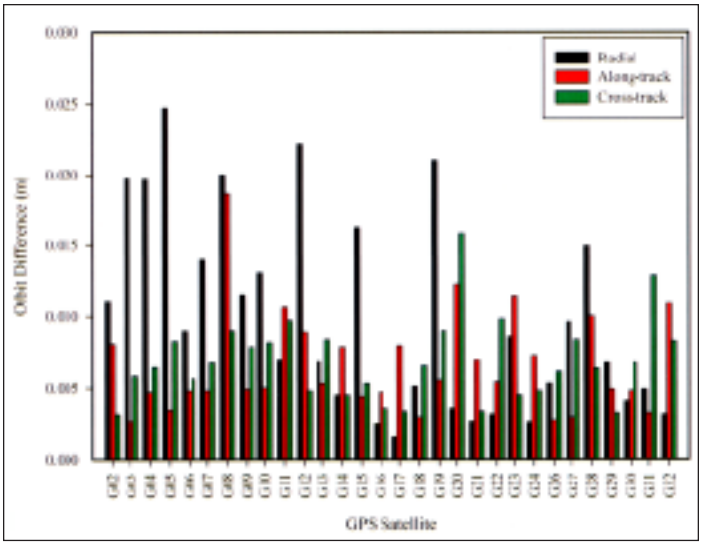

Figure 2. Impact of Second-Order Ionospheric Delay on GPS Satellite Orbit

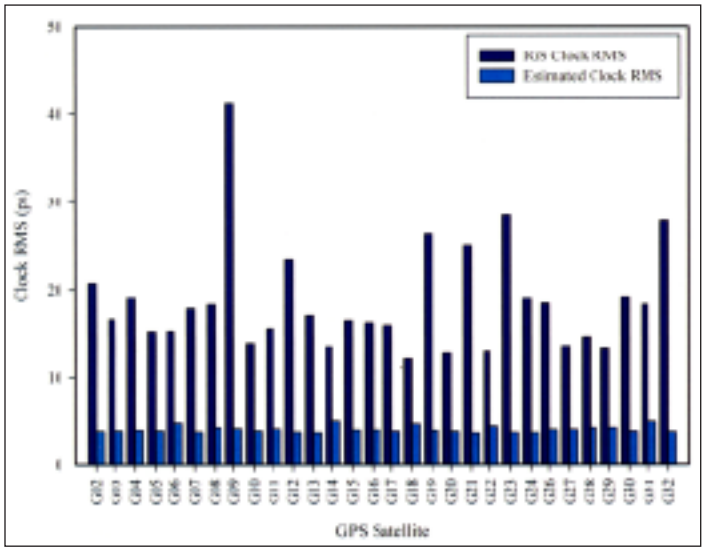

Figure 3. Impact of Second-Order Ionospheric Delay on GPS Satellite Clock Corrections RMS

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Some Recent Advances in GPS – Precise Point Positioning

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on GPS satellite orbit ranges from 1.5 to 24.7 mm in radial, 2.7 to 18.6 mm in the along-track, and 3.2 to 15.9 mm in cross-track directions, respectively (Figure 2). Satellite clock corrections, on the other hand, show differences within 0.067 ns (2 cm) compared with the final IGS satellite clock corrections. Figure 3 shows that impact of second-order ionospheric delay on GPS satellite clock corrections root-mean-square (RMS). Interested readers should refer to Elsobeiey and El-Rabbany (2011) for more details.

Results for undifferenced GPS PPP

The GPSPace PPP processing software, which was developed by Natural Resources Canada (NRCan), was modified to accept the second-order ionospheric correction, the NOAA tropospheric correction model, and others. To examine the effect of rigorous error modelling on the undifferenced PPP solution, GPS data from 12 randomly selected IGS stations were processed using the modified GPSPace. The data used were the ionosphere-free (with both first- and second-order corrections *included) linear combination of code and carrier-phase measurements. The estimated precise satellite orbit and clock corrections, from the previous step, were used in the data processing. The results show that improvements are attained in all three components of the station coordinates. Figures 4 through 6 show the 3D solution obtained with and without the second-order ionospheric corrections included, for station ALGO (Algonquin Park), as an example. As can be seen, the amplitude variation of the estimated coordinates during the first 15 minutes is reduced when considering the second-order ionospheric delay. In addition, the convergence time for the estimated parameters is reduced by about 15% on average. The final PPP solution shows an improvement in the order of 3 mm in station coordinates. It should be pointed out that the solution improvement is much higher at low latitudes whereas the second-order ionospheric effect ‘is much higher.

Results for between-satellite single-difference model (BSSD)

GPSPace was further modified to perform between-satellite single difference observables. A major advantage of BSSD over the undifferenced mode is that the GPS receiver clock error, receiver hardware delay and non-zero initial phase of the receiver’s oscillator are cancelled out. This, however, comes at the expense of introducing mathematical correlations to the BSSD observables. Such mathematical correlation, however, can be easily obtained by applying the law of covariance propagation. To examine our BSSD model, we processed the same data sets at the 12 IGS stations again. The results show that the solution convergence has improved at all stations by 20% to 50%. This improvement is significant and is considered a major step towards real-time PPP, Figures 4 through 6 compare the results obtained for ALGO with both the undifferenced and BSSD modes.

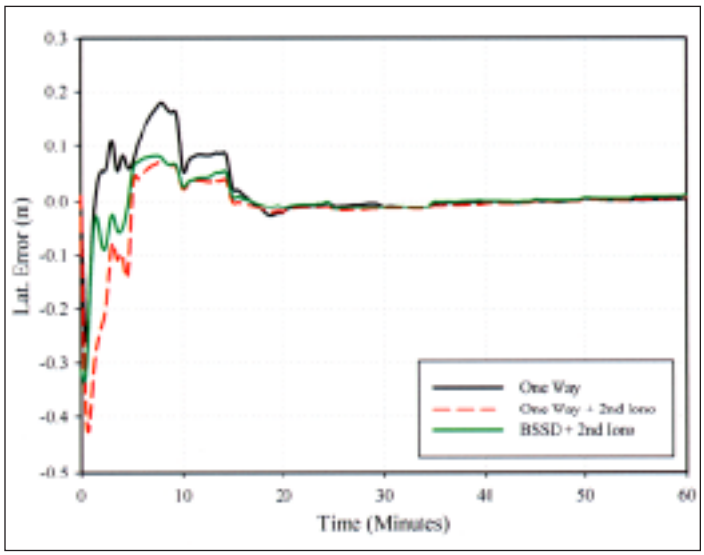

Figure 4. Latitude Improvement Using BSSD and Second-Order Ionospheric Delay vs. Undifferenced Model

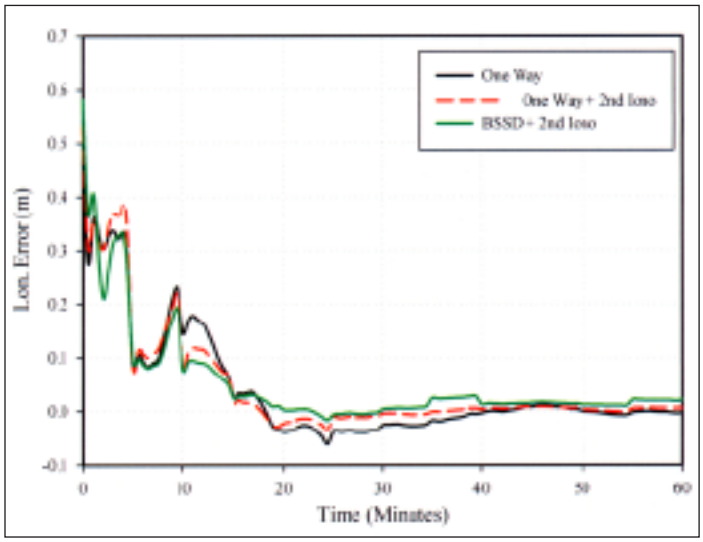

Figure 5. Longitude Improvement Using BSSD and Secon-Order Ionospheric Delay vs. Undifferenced Model

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Some Recent Advances in GPS – Precise Point Positioning

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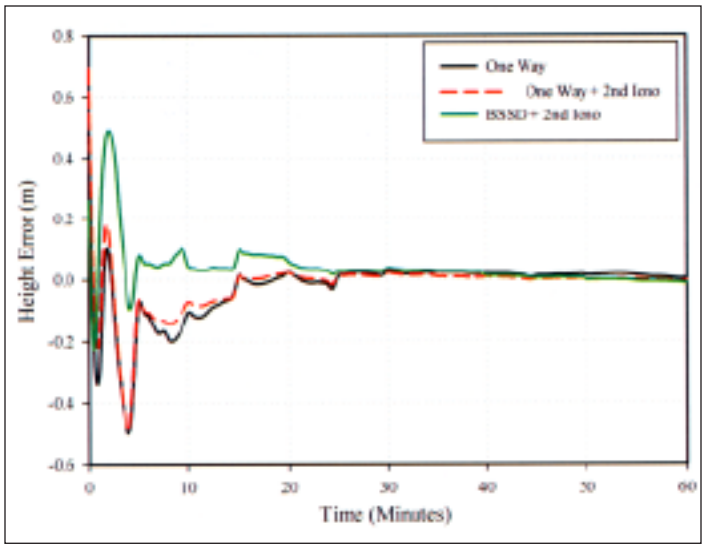

Figure 6. Height Improvement Using BSSD and Second-Order Ionospheric Delay vs. Undifferenced Model

Conclusions and future outlook

It has been shown that rigorous modelling of GPS residual errors can improve the PPP convergence time and solution. It has been shown that neglecting the second-order ionospheric delay can produce an orbital error ranging from 1.5 to 24.7 - in radial, 2.7 to 18.6 - along-track, and 3.2 to 15.9 mm in cross-track directions, respectively. In addition, neglecting the second-order ionospheric delay results in a satellite clock error of up to 0.067 ns (i.e. equivalent to a ranging error of 2 cm). Moreover, accounting for the second-order ionospheric delay can improve the final undifferenced PPP coordinate solution by about 3 mm and improve the convergence time of the estimated parameters by about 15%. Further improvements of up to 50% in the PPP solution convergence can be obtained when the BSSD model is used. This is very encouraging and is considered as a major step towards real-time PPP.

Future research will develop a PPP ambiguity resolution technique for precise real-time surveying applications.

Acknowledgments

This research was supported in part by the GEOIDE Network of Centres of Excellence (Canada) and by the Natural Sciences and Engineering Research Council (NSERC) of Canada. The authors would like to thank the Geodetic Survey Division of NRCan for providing the source code of the GPSPace PPP. The data sets used in this research were obtained from the IGS website http://igscb.jpl.nasa.gov/.

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References

El-Rabbany, A., 2006. *Introduction to GPS: The Global Positioning System*. Second Edition. Artech House Publishers, USA.

Elsobeiey, M. and A. El-Rabbany, 2011. Impact of second-order ionospheric delay on GPS precise point positioning. Journal of Applied Geodesy. Volume 5, Issue 1, pp. 37-45.

Gutman, S., T. Fuller-Rowell, D. Robinson, 2003. Using NOAA Atmospheric Models to Improve Ionospheric and Tropospheric Corrections. U.S. Coast Guard DGPS Symposium, Portsmouth, VA, 19 June.

Hernández-Pajares, M., J. M. Juan, J. Sanz, and R. Orús, 2007. Second-order Ionospheric Term in GPS: Implementation and Impact on Geodetic Estimates. Journal of Geophysical Research, VOL. 112, B08417.

Hoque, M. and N. Jakowski, 2007, Higher order ionospheric effects in precise GNSS users in Europe. GPS solutions Vol. 12, No. 2, pp 87-97.

Lutz, S., S. Schaer, M. Meindl, R. Dach, and P. Steigenberger, 2010. Higher-order Ionospheric Modeling for CODE's Next Reprocessing Activities. Proceeded in the IGS Analysis Centre Workshop, Newcastle upon Tyne, England, 28 June - 2 July 2010.

National Oceanic and Atmospheric Administration (NOAA) website, http://www.ngdc.noaa.gov/IAGA/vmod/igrf.html (accessed April 2011).

Rowell, T. F., 2005. USTEC: a new product from the Space Environment Centre characterizing the ionospheric total electron content. GPS Solutions, Springer-Verlag. Vol. 9, pp. 236-239.

Managing Employee Benefits In Difficult Economic Times

(continued from page 16)

WORKPLACE PRODUCTIVITY

Implementing wellness programs can be a real cost-cutting tool.

That's why health management is an integral part of any cost-cutting program. According to the Wellness Councils of America, some small businesses are experiencing a $24 return for every $1 spent on their companies' wellness programs. The services that are typically included in a corporate wellness program include health screening, training and education seminars and webinars on healthy lifestyles, access to online health management software programs, worksite fitness center management and other proven successful tactics.

Given the complexity and uncertainty of today's healthcare landscape, working with the healthcare benefits consultants at USI Affinity is more important than ever. Large companies have been enjoying the benefits of employee wellness programs for a number of years, but small and mid-size firms can also benefit from employee wellness programs. The goal of USI Affinity's Benefits Solution Group is to create cost effective, proactive, longterm health management plans to benefit companies in their ongoing efforts to deal with employment benefit programs in a down economy.

Employers are more active today in motivating individuals to pursue healthier lifestyles. Driven by increases in healthcare costs, employers continue to look for new and innovative solutions to the problem of health risk management in the workplace.

USI AFFINITY RESOURCES – A NYSAPLS Member Advantage Program Affinity Partner

USI Affinity was formed in 2004 through the merger of USI Colburn Insurance Service, Bertholon-Rowland Corp., American Insurance Administrators and Travel Insurance Services. USI Affinity continued to expand when it acquired Vista Wholesale Insurance Partners in 2005, the Carlson Group in 2006 and Future Planning Associates in 2007, and is now listed as the 10th largest insurance brokerage firm in the nation according to industry rankings conducted by Business Insurance Magazine.

By combining the experience and expertise of each of these seven organizations, USI Affinity has emerged as one of the leading providers of insurance, financial and risk management services to professional associations, individuals and small-business owners.

For over 75 years, the divisions of USI Affinity have developed, marketed and administered insurance and financial programs that offer affinity clients and their members unique advantages in coverage, price and service. Our programs offer clients, from associations and unions to financial institutions, the edge they need to both retain existing and attract new members and customers. As the endorsed provider of affinity groups representing over 20 million members, USI Affinity has the experience and know-how to navigate the marketplace and offer the most comprehensive and innovative insurance packages available.

The Benefit Solutions Group of USI Affinity specializes in providing comprehensive employee benefit programs to businesses and employers. Our employee benefit sales consultants have on average 20 years of experience in the marketplace.

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Surveyor's Rendezvous 2012

The National Surveyors Historical Society's 2012 Rendezvous will be held September 13-15, 2012 in Council Bluffs, Iowa and will focus on Lewis and Clark's meeting with the Oto and Missouria delegation in 1804, the 150th anniversary of the Pacific Railroad Act of 1862, the 150th anniversary of the Homestead Act of 1862 and the 200th anniversary of the creation of the General Land Office.

Visit www.surveyorshistoricalsociety.com for background on previous years' Rendezvous and for 2012 information when it becomes available. Make plans now to attend in Council Bluffs this fall!

Action Update on Unified Organization

by Bill Coleman, PLS, GISP, NSPS President

It has been seven weeks since the ACSM Congress voted to disband and the NSPS began the process to create a new "unified organization" that would represent the broad definition of the "Professional Surveyor". Many of you have asked if anything has been done to begin this process.

Let me tell you what has been accomplished and what goals Is have been set.

1. A Strategic Planning Committee has been appointed to conduct a financial analysis of our existing organizations and make recommendations for new membership categories and rates within the new organization. The committee is comprised of representatives from all of the member organizations and chaired by Pat Smith (TX), Chair of the NSPS Board of Governors. This committee has been asked to complete its mission by the end of September to enable a budget to be prepared and dues notices for next year to be mailed.

2. The combined Membership Committee/Member Benefits Committee/Public Relations Committee has been directed to review a11 of the current benefits being offered to the membership to determine the perceived value of these benefits. They are to recommend what benefits should continue, what needs to be modified or discarded, or new benefits that need to be added. They too have been asked to complete their study by the end of September.

3. Executive Director Curt Sumner and staff had a preliminary discussion with our accounting firm of Gelman, Rosenburg, and Freedman to discuss the financial impacts of our reorganization and the reporting to the IRS.

4. The NSPS Executive Committee has directed Executive Director Sumner to request a proposal from the law firm of Weinberg, Jacobs, and Tolani for legal services related to the combining of the affected organizations.

5. The NSPS Executive Committee is waiting for the final financials from the Survey Summit to determine what financial steps will be necessary to complete the current fiscal year and plan the 2012 budget.

Work is progressing. We are working at a deliberate pace as we proceed. There are still many things to do before we can complete our objective and we do not want to blindly plunge headlong into the unknown.

We have started the journey to a new organization where we want all professional surveyors to be a member. We ask for your continued support.

Minimum Standards Workshop

July 14, 2012
Lodge of Four Seasons
Lake Ozark, MO

Units of Measure

Reprinted from *Georgia Land Surveyor*

- **Acre** - The (English) acre is a unit of area equal to 43,560 square feet, or 10 square chains, or 160 square poles. It derives from a plowing area that is 4 poles wide and a furlong (40 poles) long. A square mile is 640 acres. The Scottish acre is 1.27 English acres. The Irish acre is 1.6 English acres.
- **Arpent** - Unit of length and area used in France, Louisiana, and Canada. As a unit of length, approximately 191.8 feet (180 old French 'pied', or foot). The (square) arpent is a unit of area, approximately .845 acres, or 36,802 square feet.
- **Chain** - Unit of length usually understood to be *Gunter's chain*, but possibly variant by locale. See also *Rathbone's chain*. The name comes from the heavy metal chain of 100 links that was used by surveyors to measure property bounds.
- **Colpa** - Old Irish measure of land equal to that which can support a horse or cow for a year. Approximately an Irish acre of good land.
- **Compass** - One *toise*.
- **Cuerda** - Traditional unit of area in Puerto Rico. Equal to about .971 acres. Known as the "Spanish acre".
- **Engineer's Chain** - A 100 foot *chain* containing 100 links of one foot apiece.
- **Furlong** - Unit of length equal to 40 poles (220 yards). Its name derives from "furrow long", the length of a furrow that oxen can plow before they are rested and turned. See *Gunter's chain*.
- **Ground** - A unit of area equal to 2400 sq. ft., or 220 sq. meters, used in India.
- **Gunter's Chain** - Unit of length equal to 66 feet, or 4 poles. Developed by English polymath Edmund Gunter early in the 1600's, the standard measuring chain revolutionized surveying. Gunter's chain was 22 yards long, one tenth of a *furlong*, a common unit of length in the old days. An area one chain wide by ten chains long was exactly an acre. In 1595 Queen Elizabeth I had the mile redefined from the old Roman value of 5000 feet to 5280 feet in order for it to be an even number of furlongs. A mile is 80 chains.
- **Hectare** - Metric unit of area equal to 10,000 square meters, or 2,471 acres, or 107,639 square feet.
- **Hide** - A very old English unit of area, a hide was of variable size depending on locale and the quality of the land. It was the amount of land to support a family, and ranged from 60 to 180 acres. After the Norman conquest in 1066 it became standardized at around 120 acres.
- **Hundred** - An administrative are larger than a village and smaller than a country. In England it was 100 *hides* in size, and the term was used for early settlements in Virginia, Maryland, and Delaware.
- **Labor** - The labor is a unit of area used in Mexico and Texas. In Texas it equals 177.14 acres (or 1 million square varas).

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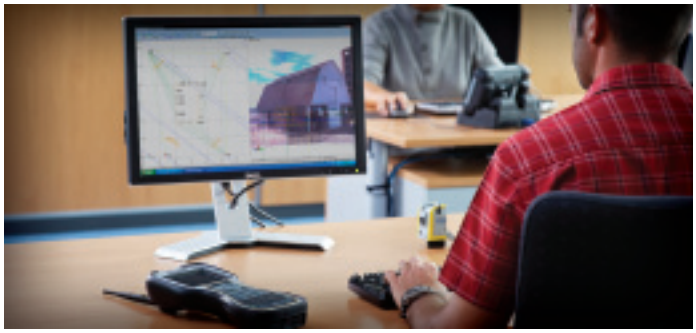

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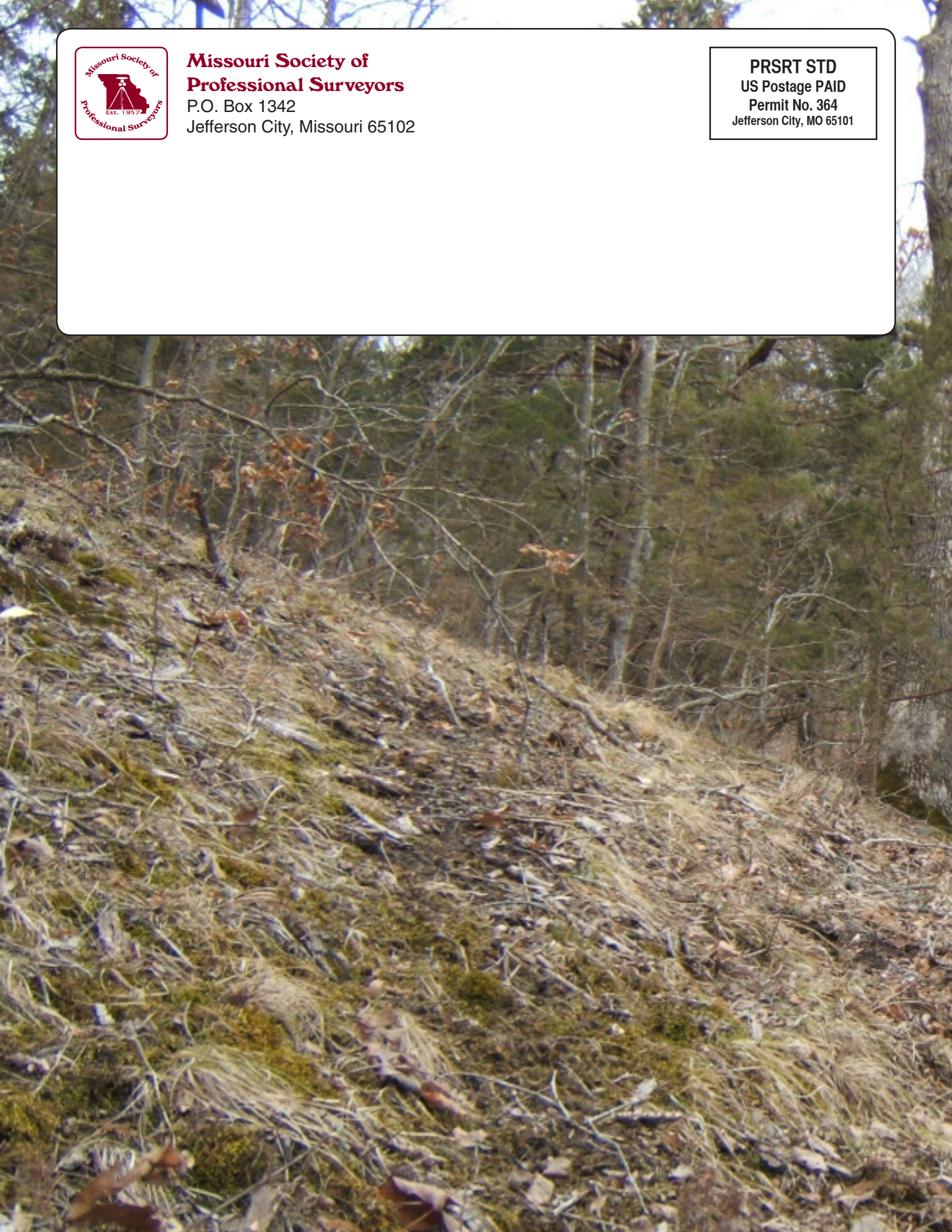

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