

The Tarheel

SPRING 2016 | No. 16.1

SURVEYOR

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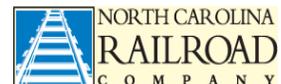
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The Tarheel SURVEYOR

Spring 2016

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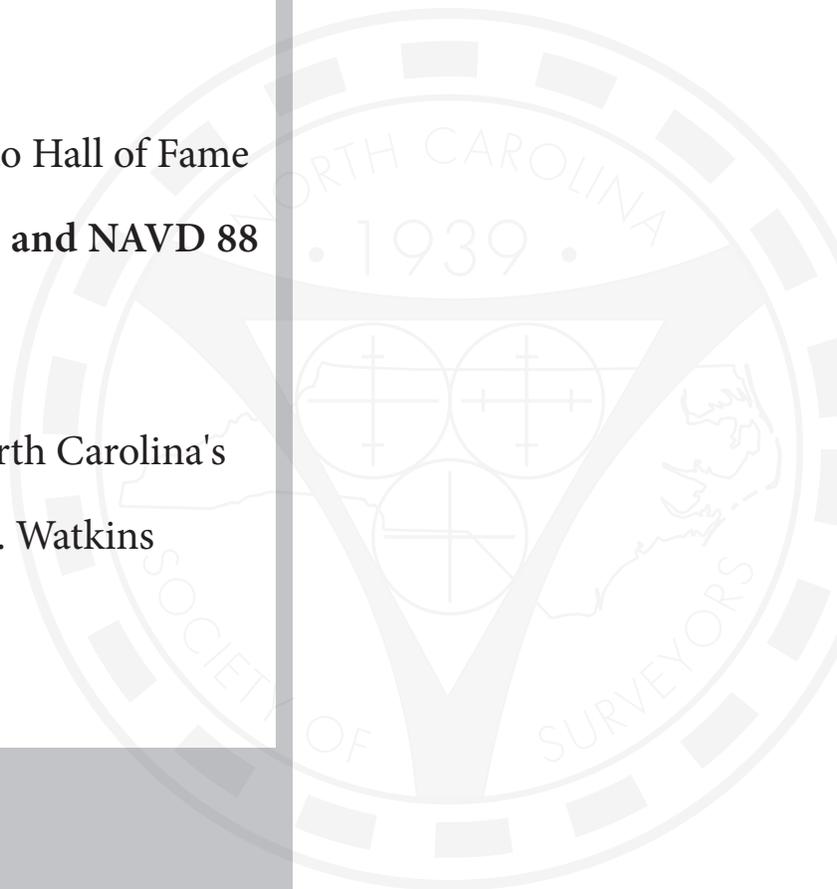
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ABOUT NCSS:

- >Founded January 31, 1939
- >Second oldest professional surveying organization in the United States
- >Only professional surveying organization in NC
- >Affiliated with the National Society of Professional Surveyors and, therefore, all Professional Members are also accounted as members of NSPS as of July 1, 2013

OUR MISSION:

"A society of professional surveyors and their associates dedicated to enhancing professionalism, improving legislative awareness and promoting the profession of surveying."



WHO WE ARE



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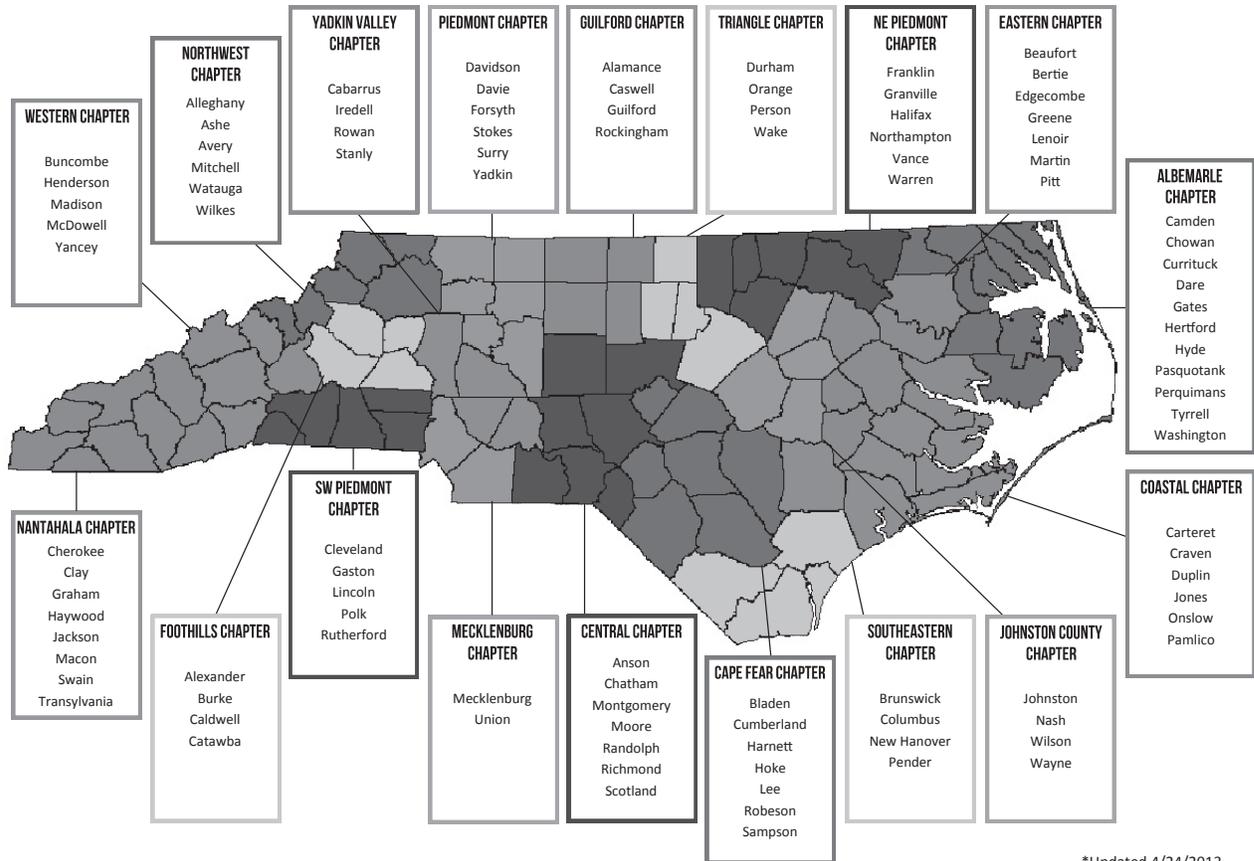
MARKETING & MEMBERSHIP DEVELOPMENT

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CHAPTER MEETINGS

CHAPTER	DATE & TIME	LOCATION
Albemarle	3rd Tuesday 6:30 pm	Cypress Creek Grill, Elizabeth City
Cape Fear	Last Thursday 6:30 pm	Various Locations, Fayetteville
Central	Last Tuesday 7:00 pm	Westmore Family Restaurant, Westmore
Coastal	Last Monday 6:30 pm	Texas Steakhouse, Morehead City
Eastern	2nd Monday 6:30 pm	Parker's BBQ, Greenville
Foothills	2nd Tuesday, 7:00 pm	Timberwoods, Morganton
Guilford	3rd Wednesday 6:00 pm	The Porterhouse Grill, Greensboro
Johnston County	2nd Tuesday 6:00 pm	Holt Lake BBQ, Smithfield
Mecklenburg	1st Monday 6:00 pm *no meeting Jul-Aug	Dilworth Grille, Charlotte
Nantahala	3rd Tuesday 6:30 pm *no meeting Jun-Aug	Sunset Restaurant, Franklin
NE Piedmont	Last Tuesday 7:00 pm	Various Locations, Louisburg
Northwest	3rd Tuesday 6:00 pm	Daniel Boone Inn Restaurant, Boone
Piedmont	4th Tuesday 6:00 pm	Town & Country Restaurant, King
Southeastern	Last Wednesday 7:00 pm	Carolina BBQ, Wilmington
SW Piedmont	2nd Thursday 6:30 pm	Ryan's Steakhosue, Forest City
Triangle	3rd Tuesday 6:30 pm	Casa Carbone, Raleigh
Western	2nd Tuesday 6:30 pm	Cornerstone Restaurant, Asheville
Yadkin Valley	2nd Wednesday 6:30 pm	Ryan's Steakhouse, Salisbury

NCSS Local Chapter Areas



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DIRECTOR'S NOTES



Productivity is never an accident. It is always the result of a commitment to excellence, intelligent planning, and focused effort.
Paul J. Meyer

Although trigonometry was the only section of pre-calculus that kept me afloat in college, I am not, nor could I be, a surveyor. I don't think like a surveyor, I don't love numbers like a surveyor and I definitely would not handle ticks and yellow jackets as well as surveyors do. However, I am a planner, organizer and communicator. These traits are worth mentioning as I reflect on the accomplishments of the Society since our last publication. Efficiency and productivity come when members of an organization strive to do what they do best. Your office would not run very efficiently if my responsibility was to hack through the brush to set a corner. However, if my job inside your office was to market your services, communicate with your clients and schedule your day, I, more than likely, could benefit you. Since the fall issue of the Tarheel Surveyor, my time has been focused primarily within three areas: 1) Education, 2) Annual Conference and 3) Legislation. Since we decided to decrease the office staffing in 2014, it has become more important for me to be as efficient and productive as possible.

As a planner, scheduling education takes an enormous amount of time. I am encouraged by the continued growth and support of chapters as we endeavor to share this responsibility. We completed the fall schedule in mid-December with over \$16,000 distributed to various chapters. Reduced travel expenses for the staff to proctor and manage these events across the state, is a tangible benefit to educational partnerships. I was so encouraged when Norman Ribelin, President of the Yadkin Valley Chapter, told me at the Conference that the chapter voted to donate \$500 to our three different organizations: NCSS, MAPS, and Education Foundation. He said they had always wanted to give, but had never had any money in the past. The 2016 Spring Education Schedule looks fuller than usual; however, all but two of the classes are simply chapter seminars that our office is marketing for them. Refer to page 7 of this edition to look over the current offerings or log on to our website at ncsurveyors.com.

As an organizer, the Annual Conference requires the entire skill set from within our office. This year's 52nd Annual

Conference in Wilmington was again a success and Sherri and Michelle were invaluable in achieving that success. Thousands of tiny details went into the process and seeing everyone relaxing with friends, learning from instructors, and shopping for the newest technology and services is a great reward for us when we see the event come together. As Leland Strother said, "It's like planning a wedding every year."

Finally, as a communicator, I have had several opportunities to represent your organization politically. I attended a meeting with Senator Chad Barefoot to discuss the Infrastructure Technology Department changes. I attended a private luncheon with Representative Dean Arp which gave me opportunity to speak with him on a personal level for a few minutes. I also attended the Free Enterprise Luncheon as a guest of McGuireWoods Consulting where many of the leaders in both the NC House and Senate were present. There, I had a chance to speak with Mitch Gillespie who is currently the Speaker of the House, Tim Moore's policy advisor regarding the issue of Shellfish Boundaries. These opportunities influence the overall "face" of surveying across North Carolina.

The majority of surveyors that I meet want to be better at what they do. The public needs professionals like you because delineating property boundaries is one of the foundational issues for any society. Good luck with those numbers and insects; your staff will keep doing what we do best. It is no accident because we are committed to excellence. Please let us know how we can serve you.

Christy C. Davis

Christy C. Davis, Executive Director



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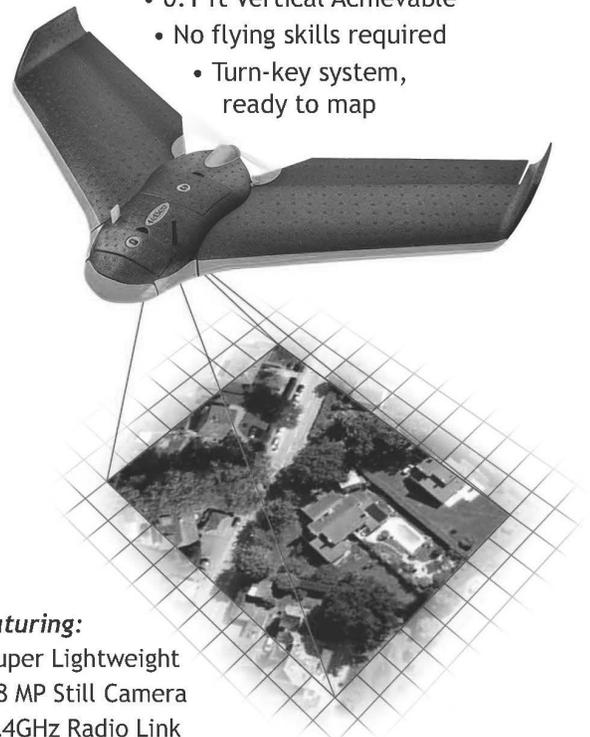


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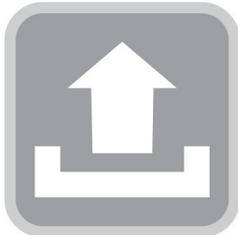
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LETTER FROM THE PRESIDENT



I would like to express my sincere appreciation to all of the surveyors, vendors and friends of the Society who came to Wilmington in February for the Annual Conference. The theme for this year's conference was "Bringing it Forward," which was personified by the image of the rodman bringing the back sight target ahead so that the crew can move forward and reach their objective. "Bringing it Forward" is all about advancement – taking the next step that is required to accomplish more. What is it that we are bringing forward? In my view, it is our profession.

I felt like this theme was appropriate for our conference and for my presidency, because "Bringing it Forward" is exactly what NCSS is all about. Through education and legislative involvement, this Society is the primary champion for surveyors in the State of NC. Can you think of any other group, organization, etc. that is looking out for land surveyors in our State?

The mission statement of NCSS is "A society of professional surveyors and their associates dedicated to enhancing professionalism, improving legislative awareness and promoting the profession of surveying." The word I want to point out in this statement is "dedicated." This mission statement only works if our members care deeply about this profession and are willing to serve with passion.

We can all think of surveyors that we respect; men and/or women that we admire for their professionalism. I named a few in my acceptance speech at the Conference. I listed folks that have inspired me because they care so deeply about the advancement of our profession. It is because of these role models that I have been an active member of this Society since 2000. These surveyors have inspired me to want to help bring our profession forward.

What does "bringing it forward" look like in your professional career? How are you helping to advance our profession?

Theodore Roosevelt said: "Every man owes a part of his time and money to the business or industry in which he is engaged. No man has the moral right to withhold his support from an organization that is striving to improve conditions within his sphere." Whether you consider yourself a land surveyor, a geomatics professional or a photogrammetrist, I believe it is your responsibility to support NCSS.

I'd like to present 3 ways that you can help NCSS bring it forward: Being a dues paying member matters! Even if you can't attend monthly chapter meetings, paying the annual dues shows that you appreciate the fact that NCSS is looking out for your profession every day of the week. So method #1, which we'll call "the rodman" level, is to pay your dues. And if you can convince others like you to simply pay their dues, we'll say that you've achieved "instrument man" status.

The second way that you can help bring it forward is to participate in NCSS functions. When you make monthly chapter meetings a priority, you show that you want to know what's going on with NCSS. You show that you care about the issues that are presented and you vote on matters that will be taken to the Board of Directors.



Schedule at a GLANCE

APRIL 1, 2016

ALTA Standards

8:00am-4:30pm

7.5 PDHs

SMS Catering

Charlotte, NC

APRIL 22, 2016

Surveyor Workshop

8:00am-4:30pm

7.5 PDHs

Craven Community College

New Bern, NC

APRIL 29, 2016

Surveyor Workshop

8:00am-4:30pm

7.5 PDHs

Outer Banks Area Realty

Classroom

Nags Head, NC

APRIL 29, 2016

Surveyor Workshop

8:00am-4:30pm

7.5 PDHs

WPCC Higher Learning

Center

Morganton, NC

MAY 13, 2016

CFS Update

12:00pm-4:00pm

4 PDHs

NCSS Office

Wake Forest, NC

JUNE 3, 2016

Surveyor Workshop

8:00am-4:30pm

7.5 PDHs

NCSS Office

Wake Forest, NC

JUNE 10, 2016

Surveyor Workshop

8:00am-4:30pm

7.5 PDHs

Location: TBD

Greensboro, NC

Volunteering for a committee is another tremendous way to help the Society. Using the legislative committee as an example, all the committee really needs for surveyors to do is read legislation and provide feedback. These committee members are not asked to drive across the State to attend meetings. They are asked to read emails and provide feedback. When you make monthly meetings a priority and/or join a committee to assist with the business of the Society, you've reached the second tier of bringing it forward, which will be called the "Party Chief" level.

When you've spent an ample number of years enjoying the outdoors as a party chief and decide to take your career to the next level, there comes a time when you have to make the dreaded transition into the office. Few of us became land surveyors to work inside and "push a mouse," but we must accept more responsibility and put aside our love of the outdoors, if we are to become project managers. The third tier of bringing it forward will be called the "Project Manager" level.

To reach the Project Manager level in the Society that protects our profession, we must take on leadership in the Society. We accept that folks like Benjy Brown can't be the chapter president year after year to carry the load for the rest of us. Someone else has got to fill his shoes. When you accept the responsibility of leadership in this Society, you vow to your fellow surveyors that you will look out for this profession for them.

And that is exactly what I pledge to do for you. Because of the passion I have admired in previous leaders of this Society, I have a passion for this Society. It is my hope that in the coming year, my leadership will inspire you. I will be here for you and I hope that you will be here for me, too.

Let's bring our profession forward together!



Chad T. Howard, PLS
NCSS President 2016-2017



Chad & Sara Howard

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On My List

Book Reviews for Surveyors

by Richard J. Homovec, PLS

1) *What is Landscape?* by John R. Stilgoe. MIT Press 2015

2) *The Lost Art of Reading Nature's Signs* by Tristan Goodley. Workman Publishing 2015

Both aforementioned books will enhance the surveyor's sensory awareness in the landscape. Both books cite surveyor and the utility and humanitarian (legal) dimensions of the profession. The feel of the land for surveyors is at risk as said profession marches towards an academic base.

In the book *What is Landscape?*, we learn that "Acre" became a measurement of work applied to earth, then a measure of earth's surface, part of an intricate, sensible system of measurement. "The system emphasized the division of wholes especially among the poor."¹ This was determined by English Common Law. The referenced passage recalled what I had read in *The Evolution of Everything* by Matt Ridley regarding that English Common Law was "drawn from regions and customs across the land."² This was compared to continental Civil Law in which the government writes the laws. Who would ever imagine that there is social justice incorporated into the Acre? It was customary among the English to respect boundaries and proportionally allocate resources.

John Stilgoe illustrates that the ideal field was tilled along an East-West bearing. This allowed for the maximum solar exposure for the plants. The one-directional plow was directed to the right, and uphill. From the surveyors' training, we can remember the ephemeris which dissects the East-West bearings (right ascension) as twenty-four hours from which an azimuth can be determined.

The surveying community will appreciate an author who refers to George Atwell's 1600's book *The Faithful Surveyor*. Revelations by photogrammetry are also covered.

The Lost Art of Reading Nature's Signs by Tristan Goodley can supplement the surveyor's forensic abilities. Plants can be used as compasses, altimeters and barometers. The type of flora and soil type can indicate a history of human habitation. The section on fence location, orientation and type reminded me of a NCSS seminar by Don Wilson, PLS on fences. Both

authors use said fences as evidence of the land's history.

Mr. Goodly reminds us that everyone is born with measurement devices: 1) feet which enable us to pace distances; 2) appendages (the digits on our hands) which allow us to measure angles and time. (This reviewer used the first in the field and the second while at sea to determine when the lookout relief could be expected.)

Positional accuracy and orientation methods evolved. Mr. Goodley travels to some of the most remote parts of the world to connect with some of the most "primitive" people who can maintain the aforementioned parameters with no tools, within 10 degrees of GPS waypoints-after several days traversing through rugged jungle. These people do not use a North-South, East-West orientation system.

The Lost Art of Reading Nature's Signs should resound with surveyors' training in the priority of calls for natural monuments. This publication may assist in the forensic evaluation of said topic.

What one can absorb and what one can report about the landscape is of critical importance, especially if the surveyor is required to be an expert witness.

Both books contribute to these abilities and are content rich. The readers will be blessed if they can retain a fraction of the content. Ironically, they encourage one to stop reading and go outside.

These books may be located at:

<https://mitpress.mit.edu/disciplines/architecture/landscape-architecture>

<http://www.naturalnavigator.com/>

<http://www.mattridley.co.uk/>

1 *What is Landscape* by John Stilgoe, MIT Press 2015 p 157.

2 *The Evolution of Everything* by Matt Ridley Harper Collins 2015 p 34.



Richard J. Homovec returned to surveying after careers as professional photographer, and US Merchant Mariner. He has worked aboard NOAA and US Navy Special Projects and Survey ships conducting Hydrographic Surveys. Other employment including Photogrammetry and conventional Land Surveying in both public and private sectors. He is currently employed as Staff Surveyor with the City of Raleigh.

Milestones in Education

by Peggy Fersner, PE

It was good seeing all of the familiar faces at the NCSS Conference in Wilmington this past month. Thanks to all of you that stopped by and caught up with the progress of the Geomatics program. We are excited about the recurring generous \$5000 award for scholarships from the NCSS Education Foundation. This money will be used once again to provide a one-time award of \$500.00 for the first ten people to apply, be accepted, and enrolled for at least 5 credit hours in the program. Of the ten students that received this award for the last academic year, seven are still working toward their degree. We consider this to be a great success.

In preparation for composing this article, I went back and read the last four submittals and I realize how slow academia can move. We have been reporting for a while about the creation of a joint Applied Geospatial Science and Technology program with UNCG and this is still ongoing. Our Provost just requested more information this week that we need to provide. This process is starting to feel similar to the process of submitting plans to a municipality, receiving comments, making those changes and resubmitting only to repeat this process time and time again. We remain optimistic about this joint program and will continue to push forward.

For years, we have been working with Gary Thompson to broker the creation of what is called an Exchange on the UNC Online portal (<https://online.northcarolina.edu/>). When we first looked at this option, only the Foreign Language Exchange existed, and we were told that no more would be created in the foreseeable future. During this past year, that has changed and Exchanges are now being encouraged. This program would provide any student enrolled full-time at one of the other 15 UNC system universities the opportunity to take any Geomatics course online with no additional cost to them. This provides an avenue for engineering and GIS majors or any allied program to obtain their Geomatics courses necessary for licensure. We have met with the departments of Biological and Agricultural Engineering at NC State, and have had discussions with the Civil Engineering Technology program at UNC-Charlotte, both of whom are excited about this prospect. The only hurdle remaining is how course equivalencies would be listed on the student's transcript. Let's say a NC State student registers for our GEOM 360 –

Geodesy class. There must be a course equivalency at NC State that appears on the student's transcript. Obviously, there is none. We are working with staff at UNC Online to arrive at an "elegant" solution to this issue. Once that problem is solved, we will then initially work with NC State and UNC-Charlotte to implement this solution for the course equivalencies and use those as a model for other interested programs. All of this work will allow allied programs to obtain the courses needed to sit for licensure.

Frequently, I get asked how we handle labs for our distance students. First, the majority of our distance students are employed in the Geomatics area in some fashion. Their familiarity with equipment and CAD definitely surpasses a traditional campus student. We want to then focus on the theory and the science of the Geomatics topics. However, there still are some laboratory courses. For Jerry's GEOM 317, Automated Mapping course, he uses an online simulator for the data collector. This process allows students to solve problems that may be encountered in the field. With my GEOM 205, Surveying II class, we physically get together twice during the semester on a Saturday for field work. We found that early on these students enjoyed meeting their online counterparts with whom they will likely progress throughout the program. Finally, we send the lab exercise to the professional who administers the lab to our student. All three methods offer a unique way of administering these labs.



Peggy Fersner is the Geomatics Coordinator at NC A&T State University in Greensboro. She has been on staff since 1993, teaching surveying, GIS, and hydrology courses. She has earned both her BS and MS in Civil Engineering.



GEOM 215 Class: Peggy Fersner, Adam Canoy, Jason Boyles, Jeff Jones, and Christopher Glosson



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NCSS Education Foundation

by James E. Davis, PLS
Education Foundation President



The NCSS Education Foundation begins a new year with one newly-elected board member and the same slate of officers. The newly-elected board member is Billy DiGiacomo. Returning

members are Charles Morgan, Larry Greene, Lora Younts, Jim Davis (President), Doug Suttles (Vice President), John Furmage (Treasurer,) Charles Morgan (Secretary), Gale Brown and Chris Witherspoon. Rolling off the board was Frank Mundy. Frank was recognized at the recent NCSS Conference during the Presidential Awards Banquet for his six years of service on the board.

The NCSS Education Foundation continues to work for the membership to increase the opportunities for higher education in surveying in North Carolina. We are wrapping up a very successful raffle season which resulted in approximately \$13,580 in revenue for the Foundation. This year marks three years in a row where the Foundation has sold all 100 of the cash raffle tickets. The winners of the cash raffle are as follows: First Ticket Out, Foothills Chapter (\$500); Next to Last Ticket Out, Randy Rambeau (\$500); Grand Prize, Johnston County Chapter (\$2000). Thanks to the Foothills Chapter and the Johnston County Chapter for donating their winnings back to the Foundation. The Foundation would also like to recognize the NCSS Chapters that made contributions to the raffles including Southeastern Chapter, Johnston County Chapter, Foothills Chapter, Triangle Chapter, Central Chapter, Mecklenburg Surveyors Association, Yadkin Valley Chapter, Cape Fear Chapter, Southwest Piedmont Chapter and Piedmont Chapter. We would also like to recognize Don Clements for his generous donation of a week at the beach at his condo which he has donated for many years.

The membership's support of the raffle sales program has had a direct impact on providing educational opportunities for future surveyors in the state. From 2010-2015, the raffle sales have amounted to \$55,165 in gross revenue for the Foundation. Of that revenue, 86% of the money has gone directly to students or to the endowment fund. Thank you

for your continued support.

The Foundation started a new program last year to help increase the enrollment in the Geomatics Program at NC A&T University. The program awarded \$500 incentive grants to 10 students newly enrolled in the Geomatics program. Of the 10 new students who were enrolled through the program, 7 have remained in the program through the following year. The incentive grant has been a great recruitment tool and the Foundation has decided to continue this program through the next school year.

Looking forward, the NCSS Education Foundation is looking to increase our marketing activities to help in recruiting the next generation of surveyors. After several years' absence, the Foundation has decided to participate in the NC Math Teachers Conference in order to provide information to math teachers who may have students interested in surveying. We are also looking to expand and develop the Beasurveyor.com website by working with NSPS to include information from more states. Additionally, revenue from the new NCSS License Plate Program will provide opportunities for increased scholarship awards and marketing programs. If you have any ideas for the Foundation to consider or would like to attend a meeting, please let me know or contact one of the other board members.



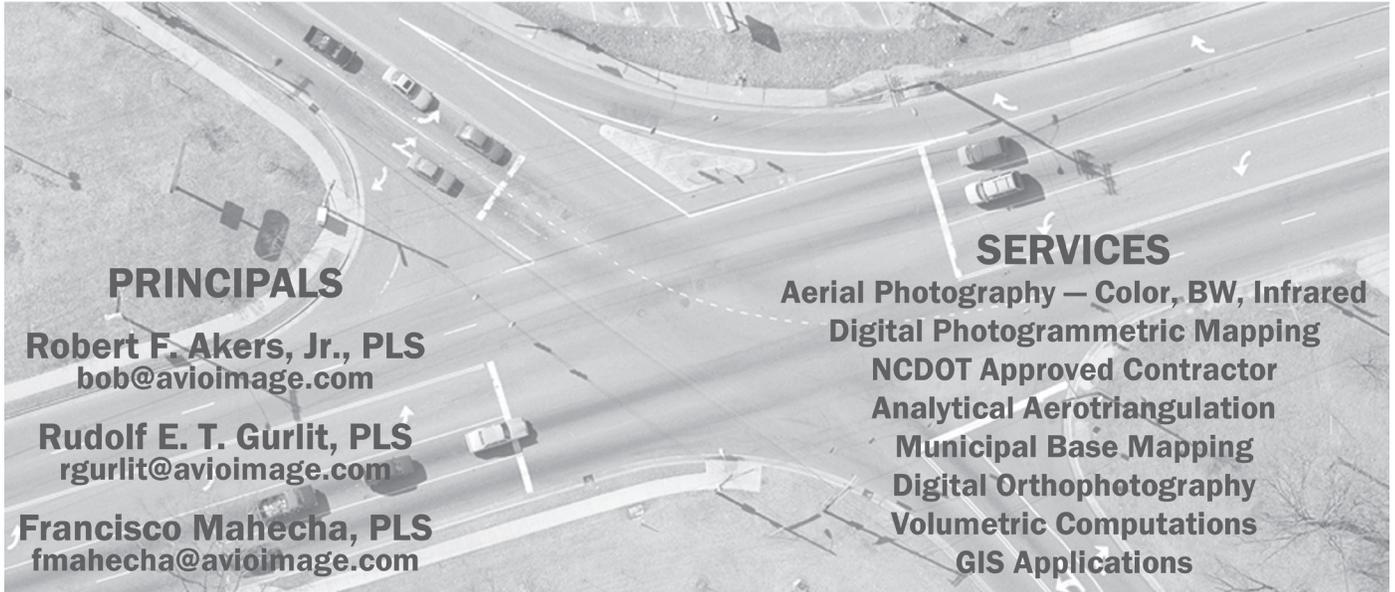
You Don't Need to be a Millionaire to Leave a Legacy

The Education Foundation can offer you an opportunity to leave a legacy (a gift of property or personal possessions) to assist the future of surveying through the education of newcomers to the profession. The following sentence included in your will is one way to ensure that you can leave that legacy to reflect your passion for the surveying profession: I give _____ (specific or identified property, possessions, percentage or residue) to the NCSS Education Foundation, Inc. (a tax-exempt organization located in Wake Forest, NC) for the purpose of supporting its education-stewardship programs. Without a will, your property or possessions will be distributed according to state guidelines which may not match your final wishes. Estate Planning is not something reserved only for the rich. Website: www.ncsseducationfoundation.com



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PROBLEM CORNER

by John Furmage, PLS

The Boundary of a certain plot of land is a square with sides 3 chains long, with an equilateral triangle on one side of the square and a semi-circle on the opposite side.

What is the area in acres, roods and perches?

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Welcome New Licensees

- | | |
|---------------------|------------------------|
| Jeremy J. Alexander | Tyler J. Hastings |
| Jonathan B. Bailey | Jeremiah L. McGalliard |
| Timothy W. Caldwell | Michael C. Sanford |
| Bruce W. Hamilton | Ron L. Zietlow |

Congratulations New Certified Floodplain Surveyors

- | | |
|------------------------|------------------------|
| Randy D. Greene | James I. Phillips, III |
| C. Andrew Heath, Jr. | James E. Scott |
| Herbert Carlton Nobles | Christopher D. Stanley |
| Aaron J. McNeill | Russell L. Whitehurst |
| Marvin J. Nunley | |

John Y. Phelps, Jr.

Inducted into NC Soil and Water
Conservation Hall of Fame



John Y. Phelps, Jr. never thought he'd be inducted into the North Carolina Soil and Water Conservation Hall of Fame. After all, he wasn't a farmer, but a surveyor who worked with urban developers. But intuitively, Phelps knew that quality of life—in both the urban city and rural country, as well as the suburbs in-between—depends on sound, science-based conservation of natural resources.

For over 35 years, Phelps gave generously of his time and energy to many conservation boards, commissions, and task force committees that worked to protect the sustainability of clean water, fresh air, and healthy soil. It is for this lifetime love of the land, that Phelps was recently inducted into the prestigious Hall of Fame by the North Carolina Association of Soil and Water Conservation Districts.

In fact, Phelps claims he was born with the conservation gene. His father was one of the original petition signers that formed the old Neuse River District in 1938. The formation of Districts in North Carolina and across the nation grew out of the necessity to address severe soil erosion during the Dust Bowl. In 1974, Phelps stepped up to serve as Supervisor on the Wake Soil and Water Conservation District Board to oversee conservation work in Wake County, serving longer than any other Supervisor in Wake District's history.

At the local and regional levels, Phelps led Wake District in establishing the county's and state's first urban sediment and erosion control ordinances, secured funding for

construction of Wake County's Crabtree Creek Watershed Projects, and simultaneously served on City of Raleigh and Wake County Planning Boards, representing farmers and rural landowners impacted by rapid urbanization and passing the first watershed zoning and stormwater ordinances.

At state and national levels, Phelps served as President of the NC Association of Soil and Water Conservation Districts, expanding the NC Agricultural Cost Share Program from a pilot to a statewide program while his work on the NC Soil and Water Commission created Cost Share Technician positions to expedite conservation work, making these programs a national model for soil and water conservation districts. During his tenure, he encouraged Wake District to achieve NACD's high standards for professionalism, resulting in national recognition and numerous NACD First Place awards for conservation, communications, education, and marketing.

Over his four decades of steadfast leadership, Phelps made many significant contributions to natural resources conservation at all levels, resulting in tremendous benefits to North Carolina's Districts, the broader Conservation Partnership, the agricultural community, and all citizens of the state. Phelps continues today as an active Associate Board member who lends his extensive expertise and influence to Wake District as it meets the growing agricultural and urban needs of one million residents.

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Replacement of NAD 83 and NAVD 88 in 2022:

A smooth transition requires stakeholders to learn, prepare, and advocate!

by Gary Thompson and Curt Johnson, NC Geodetic Survey

The current horizontal reference frame [North American Datum of 1983 (NAD 83)] and the current vertical reference frame [North American Vertical Datum of 1988 (NAVD 88)] will be replaced in 2022 with a geometric reference frame and a geopotential reference frame, respectively. The new geometric reference frame will rely primarily on the Global Navigation Satellite System (GNSS). Whereas, the new geopotential reference frame will rely on both GNSS and on the gravimetric geoid model that will be developed through the NGS Gravity for the Redefinition of the American Vertical Datum (GRAV-D) project.

The new geometric reference frame will be Earth-Centered, Earth-Fixed (ECEF), which is also known as Earth Centered Rotational (ECR) or as a Conventional Terrestrial Reference System (TRS). ECEF represents positions as an X, Y, and Z set of coordinates. The “Earth-Centered” part of its name comes from having the center of mass of the Earth as the origin (0, 0, 0). The “Earth-Fixed” part of its name comes from having its axes fixed with respect to the surface of the Earth:

- Z axis is aligned with the International Reference Pole (IRP), but the axis does not coincide exactly with the instantaneous Earth rotational axis, which has a slight wobble

- X axis intersects the sphere of the Earth at 0° latitude (Equator) and 0° longitude (Prime Meridian)
- Y axis intersects the sphere of the Earth on the Equator at 90° E longitude and 90° W longitude

Consequently, ECEF rotates with the earth, and thus, coordinates of a point fixed on the surface of the earth do not change.

As for handling tectonic plate motions, the new geometric reference frame will accommodate these movements by using velocities as shown on the [RALEIGH DOT CORS ARP\(ftp://www.ngs.noaa.gov/cors/coord/coord_08/ncrd_08.coord.txt\)](ftp://www.ngs.noaa.gov/cors/coord/coord_08/ncrd_08.coord.txt) IGS08 coordinates (Figure 1).

The new geometric reference frame will be accessed with GNSS receivers and passive monuments. It is expected to change latitude, longitude, and ellipsoid height values by 1-2 meters from the current NAD 83(2011) values.

The new geopotential reference frame will be based on a gravimetric geoid that will be developed from the GRAV-D project, which has two major gravity collecting campaigns:

- High resolution “snapshot” campaign that is being conducted by performing aerial gravity surveys of

NCRD
RALEIGH DOT
Raleigh, NC
USA

Site operated by:
NCGS

National Geodetic Survey - CORS



IGS 08
RALEIGH DOT (NCRD), NORTH CAROLINA

Created on 31Aug2011 at 09:39:28.

Coordinates

SiteLog

Photographs

Data Availability

Standard Files

Custom Files (UFCOF)

Time Series (short-term)

Time Series (long-term)

Antenna Reference Point(ARP): RALEIGH DOT CORS ARP

PID = DG4687

IGS08 POSITION (EPOCH 2005.0)

Computed in Aug 2011 using data through gpswk 1631.

X = 1026003.712 m	latitude = 35 45 49.53479 N
Y = -5078804.580 m	longitude = 078 34 44.40897 W
Z = 3706983.110 m	ellipsoid height = 50.432 m

IGS08 VELOCITY

Computed in Aug 2011 using data through gpswk 1631.

VX = -0.0144 m/yr	northward = 0.0034 m/yr
VY = 0.0010 m/yr	eastward = -0.0139 m/yr
VZ = 0.0014 m/yr	upward = -0.0023 m/yr

Fig. 1
The velocity values on the IGS08 coordinates of the RALEIGH DOT (NCRD) Antenna Reference Point (ARP).

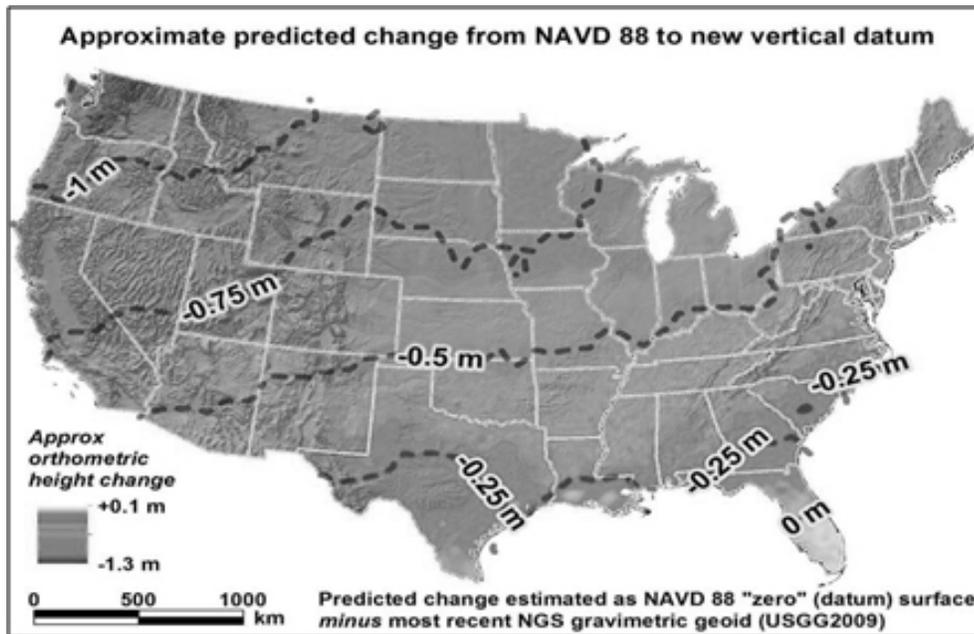


Fig. 2 The predicted change in elevation from the current NAVD 88 value to the new geopotential datum, which was estimated using the USGG2009 gravimetric geoid. Image source: NGS.

the entire U.S. and its territories (www.ngs.noaa.gov/GRAV-D/data_products.shtml).

- Low resolution “movie” campaign that is being conducted by re-visiting absolute gravity sites to monitor geographically dependent changes to gravity over time in order to allow time dependent geoid modeling, and thus time dependent orthometric height monitoring through GNSS technology.

The geopotential reference frame will be accessed with GNSS receivers and passive monuments. The target accuracy should be 2 cm relative to orthometric heights.

The new geopotential reference frame will change heights from ~0 m in the southern tip of Florida to ~ -1 m in the Pacific Northwest. As for height changes in North Carolina, NGS estimates ~-0.25 m (Figure 2).

If you use OPUS and would like your results to include an estimate of the 2022 geopotential value, then request an extended output (last page).

The new reference frames will affect any program/project with a horizontal and/or vertical component, such as the following major products and services:

- All surveying and mapping activities
- North Carolina Floodplain Mapping Program (NCFMP)
 - Digital Flood Insurance Rate Maps (DFIRMs)

- Elevation certificates
- Flood Inundation Mapping Alert Network (FIMAN)

- North Carolina Land Records Management System
- North Carolina CORS Network
- North Carolina Real Time Network (RTN)
 - Precision farming
 - Earth moving
- Light Detection And Ranging (LiDAR) and aerial imagery programs
- North Carolina Department of Transportation (NCDOT) projects
- North Carolina geospatial resources clearinghouse (NC OneMap) as well as any state government, local government, or private sector GIS program

As we make this transition to the new reference frames in 2022, we must start now to develop a transition plan:

- How can the state government, local governments, and the private sector prepare?
- How will utilizing a 4D reference frame impact surveying, mapping, construction, GIS, and engineering applications?
- Is a plate fixed solution a better option? Note: NAD83 is a plate-fixed system (North American plate)

As for whether or not NGS will define new State Plane Coordinates projections, NGS answered that question on

its “Questions about New Datums...” FAQs webpage (<http://www.ngs.noaa.gov/datums/newdatums/FAQNewDatums.shtml#WILL>) with the following statement:

Barring any significant feedback, NGS will likely define State Plane Coordinates (SPC) through the same projections and zones associated with NAD 83, but with offsets in northings and/or eastings to distinguish these new coordinates from the SPCs of NAD 83 and NAD 27.

Therefore, we also need to ask the following questions on the impacts of changing the North Carolina State Plane Coordinate System (NC SPCS):

- Do we make changes in 2022 to the NC SPCS constants (e.g. false northing and false easting)?
- If we don't change the NC SPCS constants, what will be the impact of the small change (1-2 meters) in coordinate values?
- How will a NC SPCS constant change impact county Parcel Identification Numbers (PINs) and programs like the North Carolina Land Records Management program?

The North Carolina Geodetic Survey (NCGS) is preparing for this transition by doing the following activities:

- Collecting GNSS data on existing published 1st and 2nd order benchmarks for use in the development of “hybrid” geoid models
- Developing the capability to collect terrestrial absolute and relative gravity data statewide to assist NGS with the GRAV-D project
- Drafting wording needed to revise North Carolina General Statute Chapter 102 [Official Survey Base](http://www.ncleg.net/EnactedLegislation/Statutes/PDF/ByChapter/Chapter_102.pdf) (http://www.ncleg.net/EnactedLegislation/Statutes/PDF/ByChapter/Chapter_102.pdf) for the transition from NAD 83 to the new 2022 reference frames
- Leading an advisory group (a NCSS representative will be included in the group) to review and study the transition to the new reference frames in 2022
- Working with representatives from our adjoining states to obtain input and work toward a consolidated recommendation to NGS
- Recommending that NGS include the surveying, mapping, and GIS communities in the decision making process by establishing an ad hoc group to address issues with the new reference frames. The group should include representatives from:
 - NGS leadership
 - State surveying agencies

- Professional societies
- Academia
- Private industry
- Local government representatives
- GIS Professionals

NGS and NCGS are committed to making this transition go as smoothly as possible, but it is going to require you and other stakeholders to learn about the new datums, prepare for the transition, and advocate for your needs. For more information on what to expect and how to prepare, please visit the NGS “[Replacing NAVD 88 and NAD 83](http://www.ngs.noaa.gov/datums/newdatums/index.shtml)” website (<http://www.ngs.noaa.gov/datums/newdatums/index.shtml>). On a local level, NCGS staff members are available to provide 2022 reference frame presentations at local chapter meetings. These presentations will also be posted on the NCGS “[Library](http://geodeticsurvey.ncem.org/Pages/Library.aspx?DocType=Presentation)” webpage (<http://geodeticsurvey.ncem.org/Pages/Library.aspx?DocType=Presentation>) and can be retrieved by placing your cursor over the “NCGS Program Area” column heading and then selecting the “Datums” option. If you have a question, need information, or would like to advocate for a particular issue, please feel free to contact me (gary.thompson@ncdps.gov / 919-733-3836).

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Surveys ❖ Property Survey Condemnation Maps ❖
Residential / Commercial Subdivisions ❖ GPS Surveys
(Static and RTK) ❖ Photogrammetric Ground Control ❖
GIS Mapping

Sales Tax Changes

by Kerri Burke, Senior Vice President, McGuire Woods Consulting



Within the latest state budget, several tax changes were made, including lowering income tax rates for both individuals and businesses and expansion of the sales tax to repair, maintenance and installation services.

Installation, Repairs, and Maintenance

- Effective March 1, 2016
- Removes the sales tax exemption for installation charges
- Expands the sales tax base to include gross receipts from installation, repair, and maintenance services of tangible personal property. Repair, maintenance, and installation services are defined as:
 - “To keep or attempt to keep tangible personal property or a motor vehicle in working order to avoid breakdown and prevent repairs.
 - To calibrate, restore, or attempt to calibrate or restore tangible personal property or a motor vehicle to proper working order or good condition. This activity may include replacing or putting together what is torn or broken.
 - To troubleshoot, identify, or attempt to identify the source of a problem for the purpose of determining what is needed to restore tangible

personal property or a motor vehicle to proper working order or good condition.

- To install or apply tangible personal property except tangible personal property installed or applied by a real property contractor pursuant to a real property contract.”

Retail Sales/Use Tax & Surveyors

Aside from the recent budgetary tax changes, the existing exemption for the surveying industry as it relates to retail sales and use tax remains intact.

§ 105-164.13. Retail sales and use tax.

The sale at retail and the use, storage, or consumption in this State of the following tangible personal property, digital property, and services are specifically exempted from the tax imposed by this Article:

- Sales to a professional land surveyor of tangible personal property on which custom aerial survey data is stored in digital form or is depicted in graphic form. Data is custom if it was created to the specifications of the professional land surveyor purchasing the property. A professional land surveyor is a person licensed as a surveyor under Chapter 89C of the General Statutes.

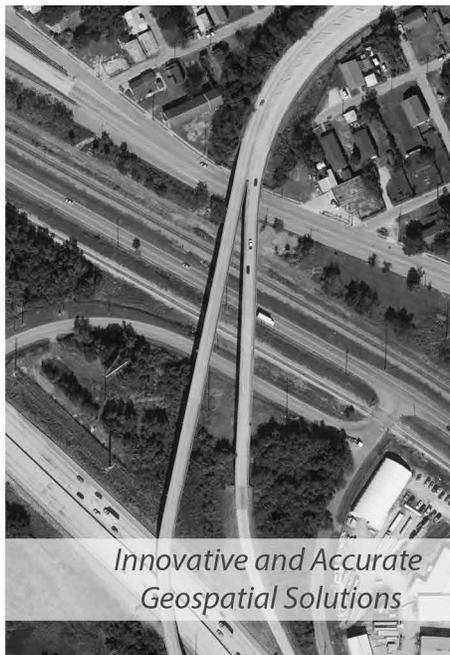
**This information is not intended nor should be construed as tax advice. For specific tax questions, please contact the Department of Revenue.*

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Once Upon

A Time *by Ken Mills, PLS*

A couple of weeks ago, I noticed something that took me by surprise. I guess I should have noticed it earlier, but with everything going on today in the surveying profession, I missed it until about a month ago.

What did I miss? I discovered many of the younger surveyors don't know how to print words or numbers. When I began my surveying career in 1969, I was taught about printing in a field book. The letters had to be very neat and clearly understood by the professional and the mapper in the office. All the letters had to be printed. Script writing was not allowed. The same was true with the numbers. I remember practicing my numbers and the alphabet at home after work so that everything I recorded in the field book, and any other notes, were as clear as could be.

I was also taught how to keep notes in the field book. Do you remember the field book? When you started a new field book, the first thing you did was number the book on the front cover and on the spine. Then you opened the book to the first page. At the top of the first page or two, you added the label "Index". The index is where you entered the job number, the client's name, and the pages where the survey data for the job was recorded. You then turned to the first page where, with the book lying flat, the page to the left and right of the center line were blank. The upper right corner of the right page was numbered 1. Both the left and right sheets were considered page 1. Then you turned the page to number page 2. This continued to the last page. Once this was done, you were ready to begin recording survey notes in the book, starting on page 1.

The note taker or crew chief listed the date, the temperature and the names of the people on the crew at the top of the right page at the beginning of the job. I have seen some people record the name of the surveying instrument and its serial number. Below this, the name of the client was entered in bold print in the center of the right side sheet. The page was then turned and the survey data entries began.

When I started on a field crew, the primary recording tool was the number 2 lead pencil. Everyone carried a pocket pencil sharpener in order to have a sharp point for clear note recording. Even the chainmen

carried a pencil for marking the tops of stakes to aid in accurately placing survey tacks in the stake.

When the 0.5mm lead mechanical pencil became available, it was like manna from Heaven. Can you imagine a pencil that never needed sharpening?! The chainmen were not left behind. We got a type of mechanical pencil with the lead about a tenth of an inch in diameter. These were used for marking stakes. The 0.5mm pencils were reserved for recording notes in the field book.

One of the main rules for taking notes in the field book was to never erase anything. If you made an error, you were to draw one and only one line through the number or word and write the correct number above the crossed-out number or note. Erasures were not allowed in the field books.

This was the rule in case the field book was presented in court for a court case. Even if there were no recording errors for the survey being tested in court, if the opposing lawyer found any erasures anywhere in the field book, it could be implied that erasures were done throughout the book and during the survey in question. This could have resulted in the field book being rejected as evidence. Also, the field book was very easy for courts to follow. Even the jurors would be able to follow the notes and understand the sketches in the field book.

When you opened the field book to any page, you would see the left side has horizontal lines for recording the notes or numbers. It was also laid out in 6 columns. The first column was used to label the point or make a brief note such as "TP 1" or "Edge Rd." The second column was used to record the plus on the rod when running a level loop or the horizontal angle when locating something. The third column was used to record the height of the instrument during a level loop or the horizontal or slope distance. The fourth column was used to record the minus rod reading during a level loop or the vertical elevation associated with the slope distance. The fifth column was used to record the elevation during a level loop or the horizontal distance as calculated from the vertical angle and the slope distance. The sixth column was used for additional notes such as the bench mark elevation.

The right page was laid out in lines across from the lines on the left side. The vertical columns are much narrower, which makes it easier to make sketches. Many times I've used both sides of a page to make a larger sketch. The sketches could be made in detail to show all manner of improvements on a property, which made for a very clear visual of the site. This helped a lot during the final mapping of the survey. On very large surveys,

sketches of property corner locations could be made to help the mapper understand what was at the corner. If you get a chance to look at an old field book, you will see the neat printing of the numbers and notes with the sketches being clear and neat as well.

Look at us today. We have data collectors, which collect the data from the surveying instrument. Then in the data collector, there is a very small box for the description of what you just located. I haven't heard of a data collector program where you can draw a sketch of what you just located. The screen is much too small. You can still bring along the old field book to record your sketches. The drawing space on one page is about 12 times larger than a data collector screen.

You can print out the raw data, and unless you are trained to decipher hieroglyphics, the only thing you see are numbers, letters and symbols with no rhyme or reason. Imagine showing the printout of the raw data to a juror. I don't think they would take the time to try to understand what was on the printout.

Today, the surveying work from the field to the final survey map is accomplished by pressing buttons. Surveyors are losing the ability to print clearly on paper. I'm having some problems deciphering phone message notes when other people take them. I've seen a combination of printing and

script in the same line. The same is true with numbers. Surveyors collect data. The data is stored in the data collector, and then transferred to the computer. On the computer screen, there are numbers and letters with lines. Everything is very neat and easy to read. When you have to use a pen or pencil, shouldn't the writing, printing, and numbers be clear and easy for anyone to read?



Ken Mills became a PLS in 1975. He has been an active member of NCSS, serving three terms as the Western Chapter President. He served as the NCSS President in 1998. Mills co-authored Following in their Footsteps with Otis A. Jones. He has written for American Surveyor Magazine and is a columnist for Madison County's News-Record & Sentinel newspaper.



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Surveyors *Bringing It Forward* are Challenged During the 52nd Annual Conference & Trade Show

by Christy C. Davis, Executive Director

The North Carolina Society of Surveyors enjoyed its 52nd Annual Conference and Trade Show on February 17-20, 2016 in Wilmington. The event was held at the Hilton Wilmington Riverside along Water Street overlooking the Cape Fear River. It was a great time to rest your body and renew your mind. Attendees gathered on Wednesday evening in our hospitality suite for the MAPS Mix and Mingle. (MAPS stands for the Museum of Archives & Preservation of Surveying.) Everyone was welcome to donate a small amount of money to our surveying preservation efforts by purchasing a chance to get the Duke vs. UNC basketball game score correct. A good time was had by all as we watched the Duke/UNC game together and the competitiveness of the contest did not disappoint anyone except the UNC fans as they lost by one point within the last minute of the game. The event



Andrew Ritter answered questions during the NCBEES lunch.

raised more than \$500 for MAPS which can be celebrated by everyone.

Thursday, our members were awarded 7.5 professional development hours (PDHs) by attending a seminar given by Rich Vannozzi of Massachusetts. He spent the morning discussing *Practical Geodesy* and addressed *Perspectives in the Future of the Surveying Profession* in the afternoon. During lunch, Andrew Ritter, Executive Director of the North Carolina Board of Examiners for Engineers



Cliff Johnson prepares for a full day of education attending Rich Vannozzi's seminar on Thursday.

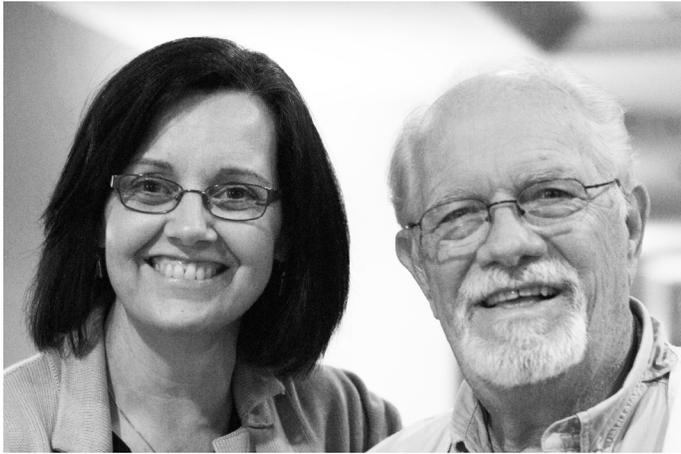
and Surveyors (NCBEES), and Mike Benton, PLS who serves on the NCBEES Board of Directors, presented to our membership the trends and plans for the future as the surveying profession keeps abreast of all the new technology. Thursday night's Vendor Appreciation Dinner was a great success as a delicious dinner was capped off by a night of casino games. This evening is designed to provide time for vendors and their clients to enjoy each other's company in a relaxed atmosphere. The grand prize package consisting of a weekend at the site of our 2017 Conference, the Pinehurst Resort, was won by Frank Mundy, PLS who



Surveyors and vendors enjoyed some light-hearted, risk free gambling during Casino Night.

had the most chips at the end of the evening.

The Trade Show opened up on Friday morning with



Christy Davis & Frank Ledford

prize giveaways and a busy exhibit hall. Optional concurrent sessions were available at three separate times during the day, awarding PDHs to those who could only attend on Friday. These sessions covered topics such as: Photogrammetry, Learned Profession, Plat of Combination or Recombination Surveys, DOT Right-of-Way and Your Survey Plat, LiDAR/UAS and Control Corner Rewrite. Our vendors were happy to join us this year, as we welcomed back familiar faces and invited several new ones. Amid our returning vendors were Transit & Level, Younts Insurance, Duncan-Parnell, Earl Dudley, That Cad Girl and Smart Vent. We also welcomed a new vendor, The Marksman, who joined us all the way from Canada. He gave away one of his patented tripods at the end of the day. Joel Johnson of the Nantahala Chapter was the lucky winner!



Marion Sandlin, NCSS Surveyor of the Year

Although plat submissions were off to a slow start, they ended up being bigger than ever, with Jason Walker taking 1st prize for his Boundary Plat.

We were also proud to host our classic surveyor games managed by Peter Brennan, PLS representing the Southeastern Chapter. The classic Chain Throw was won by Carl Corpus who also won Guess the Angle. The

Pacing contest was won by Bill Ciccolella and a newbie, Zac Green, won our newest competition, Pin Cushion Corner. Each winner won a gift card to restaurants in the area. Trevor Davis, a senior at UNC-W, hosted the Trade Show games and giveaways with high energy and a unique sense of humor. We appreciate him giving his time to NC Surveyors.

The festivities did not stop with our Trade Show. Friday night was a special evening as we honored Bobby Burns, our outgoing president, and all the past presidents of NCSS with a reception held before the evening banquet at Front Street Brewery. After taking a trolley ride to the brewery, guests were treated to delicious appetizers paired with samplings of the local brews. This event celebrated Bobby's leadership, while also honoring other past NCSS presidents



Jason Walker took home the top prize for Best Overall Plat in this year's plat competition.

attending, such as Derward Baker who was president in 1987. The Presidential Awards Banquet was also a nice evening, as Mr. Burns distributed awards to NCSS members who have contributed greatly to the profession during his tenure. This was the inaugural award for "Young Surveyor of the Year" which went to Billy DiGiacomo of the Triangle Chapter. He and his wife joined us for the event. Chad Howard, our incoming president, mentored Billy as a young surveyor so it was appropriate for Billy to win the award at the beginning of Chad's presidency. Past President Burns also awarded the Shining Star Award to Jared Ownbey, the new Western Chapter President, and the Polaris Award to Jeff Jeffreys for his work on the control corner rewrite. Finally, the President's Award went to Chris Witherspoon for his work on the specialty license plate. Last year's Surveyor of the Year, Benjy Brown, presented the coveted "Surveyor of the Year" to Marion Sandlin with "Spoon" interrupting the presentation with humor and kind words from his friends and fellow employees. Many of Marion's family members were on-

hand to witness him receiving the Society's top honor. Curt Sumner, Executive Director of the National Society of Professional Surveyors (NSPS), was our special guest this year. Mr. Sumner honored Benjamin "Benjy" C. Brown with the National Surveyor of Excellence Award. He gave the keynote address inspiring surveyors to be the best that they can be and reminded them to thank those who have helped them to become the men and women they are today. He also installed the new Board of Directors. This year we welcome 4 new Chapter Presidents: Jared Ownbey, Western Chapter; Bill Ciccolella, Piedmont



Benjy Brown received the NSPS Surveyor of Excellence Award.

to the accomplishments of perhaps NCSS's youngest President in history.



Vendors enjoyed some face time with clients.

Chapter; Marvin Nunley, Northwest Chapter; and Joel Johnson returns to the Board as the Nantahala Chapter President. Donald McNeil changed positions by moving from the NW Chapter President to beginning his service as the new NCSS Secretary/Treasurer. We also welcomed Jamie Watkins back to the Board as our new NCSS Vice President.

Work continued on Saturday morning as the winter Board of Directors meeting addressed important issues with a presentation from Jerry Nave on the Learned Profession. The presentation will be taken to all of the Chapters for discussion and as a means to answer the membership's questions. Scott Lokken gave a presentation on the National Geodetic Survey datum change coming in 2022. Nathan Hymiller, Northeast Piedmont Chapter President, discussed a recent seminar that he attended where he noticed that surveyors had been left out of the discussion for fast track erosion control plans. Cliff Johnson, Southwest Piedmont Chapter President and John Odom, Coastal Chapter President, were voted as the at-large members of the Executive Board.



Chris & Tanya Witherspoon

Chad T. Howard was installed as the 2016-2017 NCSS President commemorated by Bobby Burns passing Chad the gavel. Chad inspired members and their guests by drawing parallels between the progression of responsibility in one's professional world and those same progressions within the state society. His wife, Sara, was a proud witness



Bobby Burns passed the Presidential gavel to Chad Howard.

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Tennessee's Chimney, North Carolina's Northern Line

by C. Barton (Bart) Crattie, LS, CFM

As originally published in the Winter, 2009 issue of American Surveyor magazine.

Letter to my Father, April 1, 2007

Hey Pop,

All is well here, darn cold though. Had a hard freeze. We'll be having no pears this year.

I think it was Christmas you said rumor had it that the surveyors were drunk on the Tennessee/Kentucky line around the land between the rivers. There's something I need to tell you. All across this great country, many state lines are really, really screwed up. In every case from Colorado to Connecticut, local lore universally has it "the surveyors were drunk". Here's the true story, as far as I can tell:

Before the 1790's, there were no states of Kentucky and Tennessee. The western boundaries of the colonies of Virginia (Kentucky) and Carolina (Tennessee) at the time were the south seas simply on a King's word. The grant also called for N36 degrees, 30 minutes of parallel latitude to be the line between the two colonies. So, as with all neighbors, each wanted to know where that line was. Should be a simple task to measure and stob it off.

It all started in March, 1728 at Point Comfort on the Atlantic shore. The survey party moved through murky swamps and dense undergrowth measuring at a phenomenal rate, even taking the summer off because of an "over-abundance" of rattlesnakes. By October of that same year, an astonishing 240 miles of line had been run.

Through time, it became necessary to extend the line. In 1748, Joshua Fry and Peter Jefferson (Thomas' father) carried the line an additional 88 miles over the Appalachian Mountains. Beyond lay miles of bluegrasslands and timber, sure enticement for settlement.

Just three short years following our declaring independence from the crown, the same year Benedict Arnold reaffirmed his allegiance to the crown, gentlemen met to again extend the line. They rendezvoused at what they thought to be the terminus of the Fry/Jefferson line (actually five to six miles too far north) and continued west from August, 1779 to July, 1780. Mistakenly thinking they were being cheated, the Carolinians picked up their compasses and chains and went home early on. Unknown to the future importance of this occurrence, the Virginians were now the sole surveyors of the line.

Pop, have you been up to "Rock Castle" over in Hendersonville, Tennessee? A fellow surveyor named Daniel Smith built that home. Colonel (later General) Smith did most of the surveying on this boundary. Smith kept a detailed diary describing the hardships the men endured traversing some of the most brutal territory in the entire known country. Diplomacy with the locals, long stretches without fodder for the pack animals nor decent victuals for the sapian, and miles of line to clear, vistas to make, ever heading west, running a standard compass survey with the periodic astronomic observations as a check. Sadly, a casual look at the present day maps reveals how utterly incorrect their line was in relationship to the target line of latitude.

How far west did they go? The original grant required them to continue to the South Seas. A subsequent treaty required the party to cease at the east shore of the Tenasa (Tennessee) River, a boundary with the Chickasaw people. According to Smith's journal on March 23, 1780 "At about 10 o'clock joyfully surprised with the sight of the Tenasa River . . . Turn'd back and got to the Cumberland that night. These Rivers are but 9-1/4 miles apart, though far from mouth." Schopenhauer, the German philosopher calls this brief moment "happiness". Task accomplished, not quite to the point of beginning the next task.

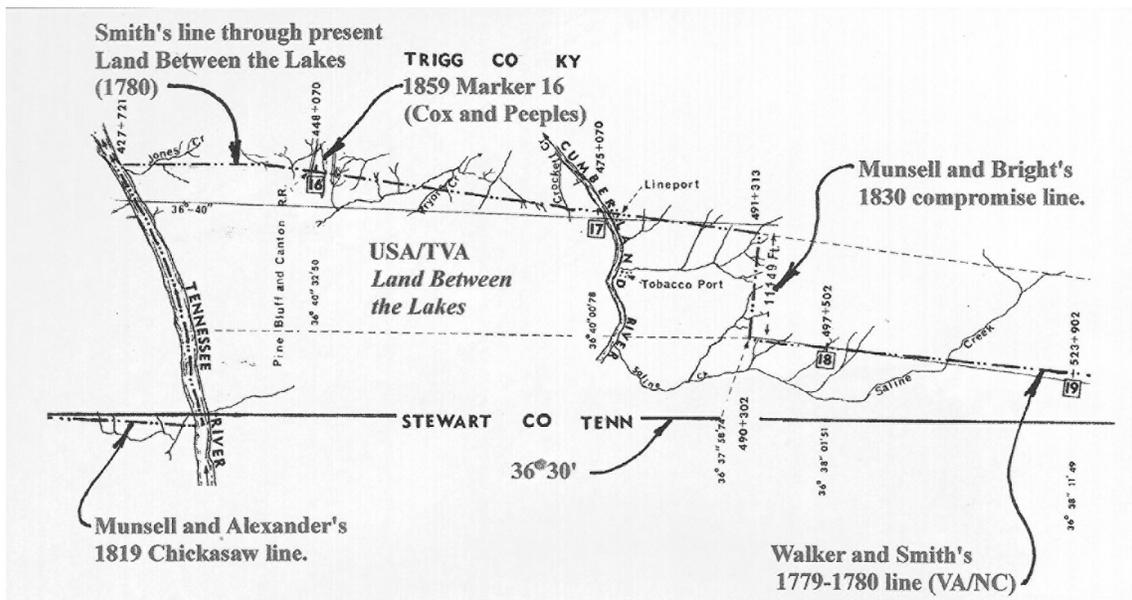
Other than a tremendous amount of property being settled as a result of rewarding Revolutionary War Veterans, nothing much really happened for another forty years. A couple of events did happen that jolted this nonchalance. Kentucky became a state in 1792 with Tennessee following in 1796. Each began exhibiting the hubris of sovereignty. The earlier mentioned Chickasaw tract west of the Tennessee River was now available for settlement through the "persuasion" of Andrew Jackson.

Someone call a surveyor.

Between 1780 (when industrial and intellectual advancements were impacting the entire world) and the year 1819, survey techniques and equipment improved drastically. In 1819, two fellow surveyors, Alexander and Munsell once again extended the line to the Mississippi River. Modern retracement shows that Alexander and Munsell's work was remarkably accurate. One small problem: their point of intersection with the aforementioned Tennessee River was about "9 miles" south of the 1780 Walker/Smith terminus.

Kentucky cried foul and challenged the entire line laid down by Walker and Smith. An irony of history: predecessors of Kentucky were the sole surveyors of the line. In 1820, Tennessee sent commissioners to Frankfort, Kentucky to resolve the conflict. Wisdom prevailed. Kentucky acquiesced to the Walker line having been occupied and observed for 40 years. In the bargain, Kentucky would receive all funds through the sale of any of the remaining unceded land.

Pop, there are folks (judges and juries) that think the line is where the mathematical description says it is. Nothing



could be farther from the truth. The line is always where it is on the ground and seldomly at the described location. No matter how much in disagreement from the perceived mathematical answer, the location of the line is where the original surveyor placed it. This principal resulted in the state of Kentucky “losing” 2,500 square miles of land. In 1858/1859 both states jointly reestablished the entire precisely incorrect line, marking it periodically with stone monuments. It was one of these stones we visited.

Well Pop, that’s pretty much the story, except why in the world is the line so terribly out of place in your neck of the woods? Remember camping at LBL, even before President Kennedy had torn down the towns and moved everyone out? Remember us boys playing mountain climbers on the iron furnaces? Think back on two telltale signs: the blue “glass” lying on the ground and Hematite Lake. The blue “glass” is a residue of iron production and hematite is the principal ore of iron. Poor old Colonel Daniel Smith had an unseen foe working against him. We surveyors call this phenomena “local attraction”.

I’d venture to posit that those gentlemen weren’t drunk when they ran those lines and made the decisions they did. I’d say the vast majority of the work was performed by sober, upright folks. I wouldn’t want to speculate as to what they did in the evenings. Corn liquor is much lighter to carry than corn.

Love always,
Bart

Evidence and Conclusions

Pop’s Christmas statement sure did stick with me. I became certain it could definitively be stated that the horrible mislocation of the TN/KY line was not caused by drunkenness on the part of the surveyors. So now, the

question was, what could be a definitive reason for this ugly and interesting line of latitude on our nation’s maps?

After that simple letter to my father, a two-year quest of curiosity and knowledge involving memorable excursions with friends and family transpired. Most important, my father experienced one of those moments that makes this profession so enchanting. We shared some valuable time together and I think he finally realized what makes this old surveyor tick.

Dad and I got out on a beautiful fall day in 2007. We were going to cover some of the old stomping grounds of both our lives. Little did we know long ago, while fishing, camping and touring in “Land between the Lakes” (LBL), that my future career would lead us both back to this idyllic locale of wonderful memories. We set out up the “Trace” and revisited the Great Western Furnace, once the focal point of the now disappeared town of Model, Tennessee. Other than the fence around it, it has not changed at all over the 45 years since we first saw it. That same stone furnace serves as a stark memorial to the iron industry that once dominated this area. Now the town is gone (Uncle Sam hauled it away) and in the National Park System’s version of reality, buffalo roam within their fence and people get paid to pretend living the lives of folks in rural Tennessee in the 1850’s.

I enjoyed my father’s eyes realizing state lines can be marked with simple yellow paint on oak and pine trees. I most enjoyed Dad’s realization that the stone we hiked off the road to go see was actually placed in the ground in 1858, not simply some stone marking an event that happened in 1858. Our work of that day, for the most part, was inconclusive, using a handheld GPS, two sight-vane compasses and an old reliable Suunto compass. One valid conclusion



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Pretty pictures don't fix instruments....

was spending a wonderful day neither of us will forget. Iron played a large role in the region's development, much as TVA would in the next century. As Burt and others later realized, iron in the ground is not conducive to compass surveying. The obvious explanation of the mislocated line is illustration in unarguable terms on a memorial sign on the grounds of City Hall in Dover, Stewart County, Tennessee. The sign proclaims the glory of "The Stewart County Iron Industry". Forty years following Smith and Walker running the line, an iron industry began a life that would thrive for another fifty years. At least 23 sites blossomed, producing iron from the very ground upon which the two surveyors' footprints left their mark.

March 23, 1780

Consistently veering northwardly, Smith and company arrive midmorning on the east bank of the Tennessee River. The day before, Smith confidently records in his diary "After observing again today, and finding the line right, sat off for the Tenasa". At this location on the line, he's many miles north of where he should be. In the month of March, he records no less than 12 observations for latitude and declinations. This consistency leads one to the conclusion that the error is systematic and therefore accumulative. This type error is correctable only if discovered, recorded by a crew that was way out there, hungry, tired and scared of Indians. The error doesn't appear to be erratic so a faulty ephemeris should probably be ruled out. When Smith got near the Cumberland River (ten miles east of the Tennessee River) also near the hidden iron fields, things really went to hell. Just how badly things went to hell might be determinable and quantified. Was it truly local attraction?

In March of 2009, about two weeks shy of 229 years to the day of Smith's joyful surprise on sighting the Tennessee River, my wife Beth, my colleague Robert Cagle, and I set out on a journey seeking resolution. Armed with dual frequency GPS equipment, a 1952 Gurley transit with Smith Solar Attachment and an abundance of picnic chow, we were, by golly, going to solve the drunken surveyor question.

The proposed method was simple and straightforward. Using the GPS, we would establish a baseline somewhere in the vicinity of the state line. That shouldn't be too hard because it runs about 10 miles across the Recreation Area from river to river. We would then observe the same line with a transit having a magnetic compass and directly compare the difference. Intentions had us making a solar observation for additional data; the rain had a different idea.

We established our random baseline in an open field located approximately one quarter of a mile north of the state line and a little more than that in a northeasterly direction

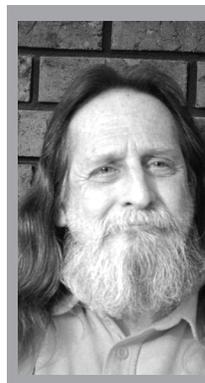
from the 1858 Mile 85 stone. Using garbage bags secured with vines from the ground for rain protection, we set up our equipment performing a three-hour static session on each end of the line. We then occupied the southern end of our base line with the transit and "zeroed" the gun on due magnetic north. We turned a left angle to the other end of the baseline and directly read a northwest bearing on the vernier as well as recording the compass needle.

The results: we post-processed the GPS data using OPUS. The resulting bearing on the baseline was Northwest 36 degrees, 18 minutes and 23 seconds. Our direct reading with the transit was Northwest 35 degrees and 26 minutes. So, local attraction at that location was only 52 minutes; not a full degree. However, when you input the current magnetic variation for that area, the transit bearing becomes Northwest 33 degrees and 18 minutes, exactly three degrees north of the GPS bearing. Applied on the ground, following the compass, one would veer in a northwesterly direction, much like Smith and Walker did prior to the extraction of the ore.

After Walker and Smith

Many state the terminus at the river is north by 17 miles. In a biography of one of the 1820 Kentucky commissioners, it is noted that if the line were projected to the Mississippi River, the line would be off by 17 miles. Based on lat and long scaled from the quad sheets, the direct distance is about 12.5 miles. Admittedly, they were way off but not nearly as far off as the local lore and librarian would have it.

That should pretty much wrap up that portion of the State Line. Some of the conclusions are based on speculation and assumption, but at least there is some plausible explanation of just how these learned men could commit such a glaring error. One thing that should finally be ruled out is the possibility that they were drunk. By the way, the southernmost portion of the line between North Carolina and Tennessee is straight as an arrow. It's been said that "the surveyors got sick of the mountains and headed straight for a tavern in Georgia".



Bart Crattie holds a BFA degree in Three Dimensional Design from Murray State University and a Survey Certification from Chattanooga State Technical Community College. He is a Certified Floodplain Manager (CFM) through ASFP. He is an LS in GA and TN. Currently is Acting Director for the TN Association of Professional Surveyors with NSPS. He formerly served on the Board of Directors for the Surveyors Historical Society and is the current Secretary of that organization.

MEMBER PROFILE

James M. Watkins



Current Position

Owner/Alliance Land Surveying, PC
Sylva, NC

Most Recent Purchase

Surveying Supplies (Stakes, Rebar, Flagging, Paint, etc...) It never ends!

First Job

Starting in 7th grade, he read water meters for his Dad when not in school.

Favorite Movies

Tombstone

Childhood Ambition

“I grew up poor, so I just wanted to be successful.”

Favorite Surveying Equipment

GPS (Magic on a Stick!)

Areas of Service within NCSS

President of the Nantahala Chapter for 2 years and Vice President for 4 years. Currently serving as Chairman of the NCSS Political Action Committee & Vice President of NCSS.

Jamie grew up in the swamps of Southeastern Louisiana. In the summer of 1987, his dad received a job offer from a utility company out of Charlotte which brought his family to NC. After only 3 months in Charlotte, he was transferred to

the Outer Banks. The Watkins family moved to Kill Devil Hills, NC where Jamie attended Manteo High School graduating in 1989. In January of 1990, he joined the United States Marine Corp serving from 1990 to 1994 as an Aviation Firefighter. In 1995, he got his first taste of surveying. From that point on, he was hooked.

In October of 1995, Jamie began working for Sylvester & Company, PA in Cashiers, NC. He started off as a rodman. After eventually proving his abilities, he was moved to instrument man.

Once leaving Sylvester & Company in 1998, Jamie moved across the state working with different surveying and engineering companies trying to learn all of the different aspects of surveying. It was 2004 when Jamie realized that he was going to need more education if he ever wanted to become licensed. This revelation came after looking at one of the sample surveying exams. Jamie noted that “there were just some things that you can’t learn while chopping line and driving hubs.” In the fall of 2004, he enrolled in the Surveying Technology program at Southwestern Community College. Under the guidance of Mr. Peter Messier, PLS, PE, he not only learned what was necessary to be a



Jamie with wife, Christy



Emily & Catherine

good surveyor, but also what it was to be a good person. While in school, Jamie worked full-time and attended classes part-time. Watkins graduated from the program in the spring of 2008. Later that same year, he became licensed, starting his own business. It was at that time that he became fully involved with NCSS. He has since added South Carolina and Tennessee to his licensure credentials and reports that his business is stronger than ever, thanks, in part, to the support and



networking afforded him by NCSS. Jamie was elected in November 2015 to the position of Vice President allowing him to serve surveyors across the state for the next four years as a member of the Executive Committee.

He has been married to his lovely wife Christy for 13 years and they have two beautiful daughters; Emily (11) and Catherine (3).

That CAD Girl

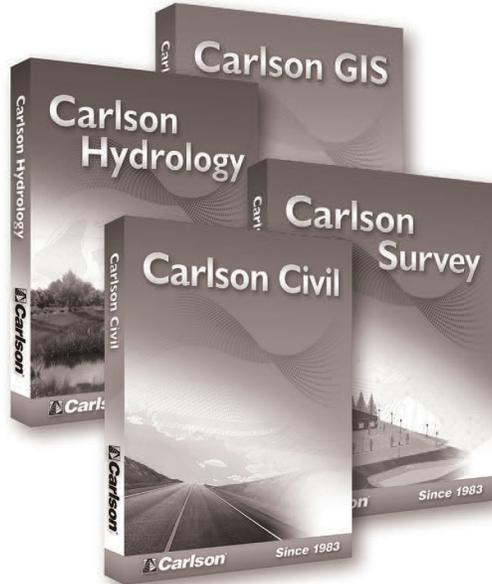
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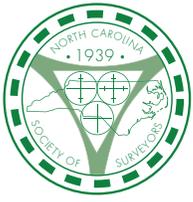


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