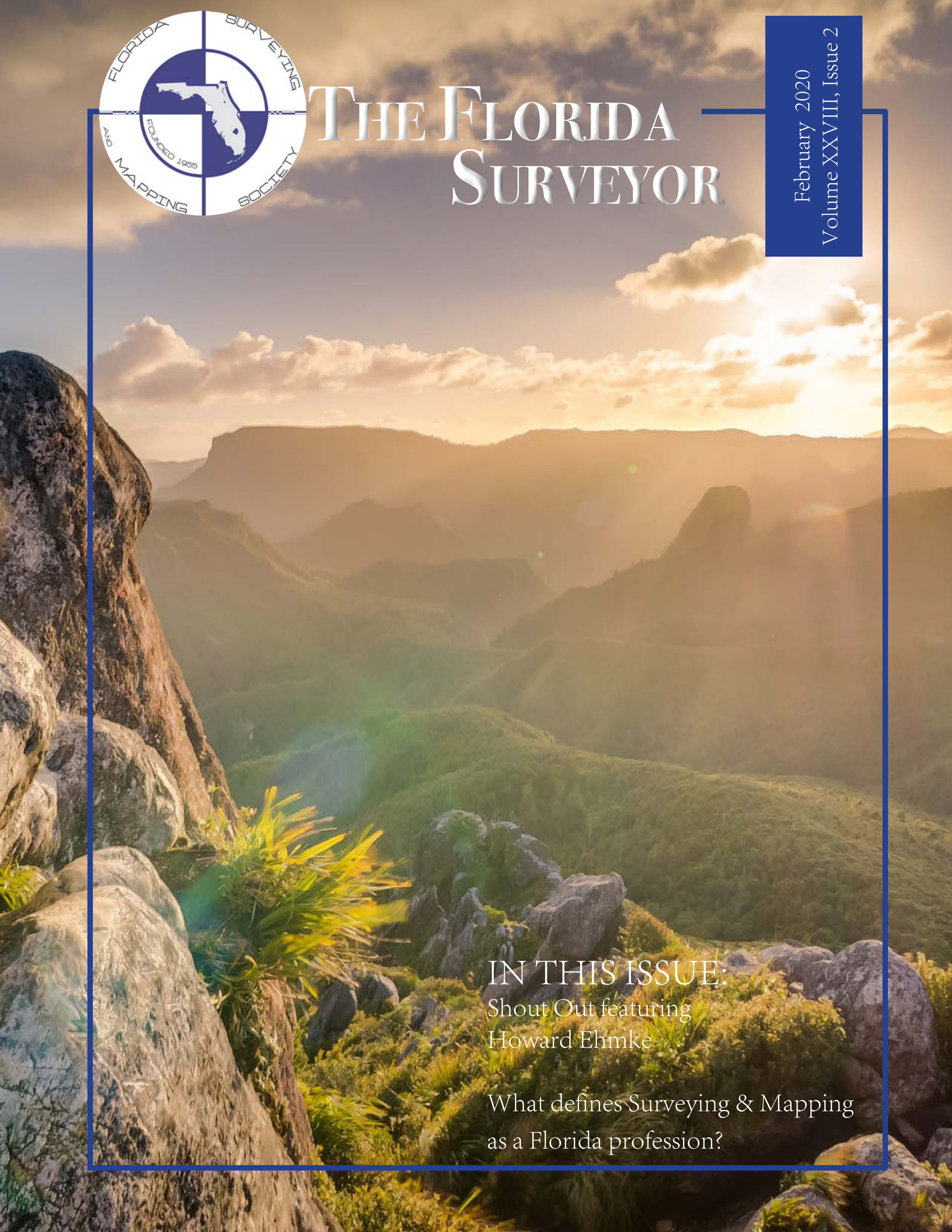

The Florida Surveyor

February 2020
Volume XXVIII, Issue 2

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Shout Out featuring Howard Ehmke

What defines Surveying & Mapping as a Florida profession?

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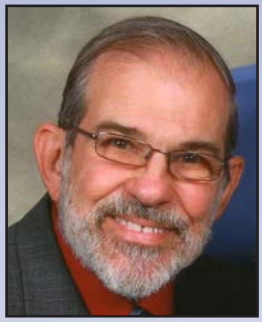

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PRESIDENT'S message

At the time of this writing, I have been President for 31 days. I knew that when I took the office, I would plan to do a variety of things, and with the help of others that we would accomplish many of them and hopefully make headway on the rest. I knew generically that the unexpected would arise, and that we would meet challenges as they came. On January 7, I got to kick off the year at a great meeting with the Panhandle Chapter.

Near the end of 2019, I got an invitation to attend a meeting of the Exterior Chapter of CIAPR on January 18 and was looking forward to seeing some of the surveyors again who I got to meet last year. For those of you who aren't familiar with this group, CIAPR is the association run by the college of engineers and surveyors of Puerto Rico, and their Exterior Chapter is based here in Florida. Last year, Dianne Collins and I began work on strengthening friendly ties between our organizations, something that is long overdue given the substantial numbers of our fellow American surveyors who have come to Florida from the island.

However, following the strong earthquakes of January 6 and 7, holding a fiesta seemed inappropriate and the CIAPR event was canceled, as some of the organizers were bound for the island to render aid. The subsequent quake of January 11 compounded the problems on the island that much more. I'd encourage everyone who can to donate to the NSPS Disaster Fund in support of our colleagues in Puerto Rico who are wrestling some harrowing conditions.

Monday, January 13 brought a different kind of unexpected challenge in the form of proposed legislation. HB 6073 and SB 1826 are bills which do far more to strip the public of safety and property protections than they do to open employment opportunities for people in the surveying industry. More will come on this front.

The rest of the week of the 13th was much more pleasant, as I got to spend time with the Chipola, North Central Florida, and Broward Chapters.

In the big picture, next up for us are widening support for what Rick Pryce and Earl Soeder have been doing to combat the scourge of equipment theft, along with finding ways to develop education programs for survey technicians.

Lack of survey technicians is a much more immediate problem for the industry than lack of licensees is. However, this is a problem we can make headway against if we do so in a unified manner. I think we can agree that at present, virtually every surveying company in the state would hire a trained technician on the spot and compensate them well.

At the first FSMS Board meeting of 2020, Director Greg Prather issued a challenge to the individual members in the room and across the state to build the reserves of FSMPAC to $50,000 by the end of the Legislative session in mid-March. Our PAC is critical for helping to support constructive legislation and budget allocations, including coastal mapping provisions and funding for restoration of tidal stations and benchmarks.

Our teammates from the Manasota Chapter are slated this week to exceed their generous $1,500 donation from February of last year with a $2,000 commitment this year. Large donations are not necessary to be meaningful – every $25, $50, or $100 helps!

Finally, Director Dodie Keith is leading this year's membership drive, so expect a call if you are not a member. If you are in the business of Florida Surveying and Mapping and are an individual or represent a firm which has been on the sidelines, suit up and join – we need you in the game!

Until next month, stay safe out there!

President
Don Elder
(850) 354-9665
donelderpsm@gmail.com

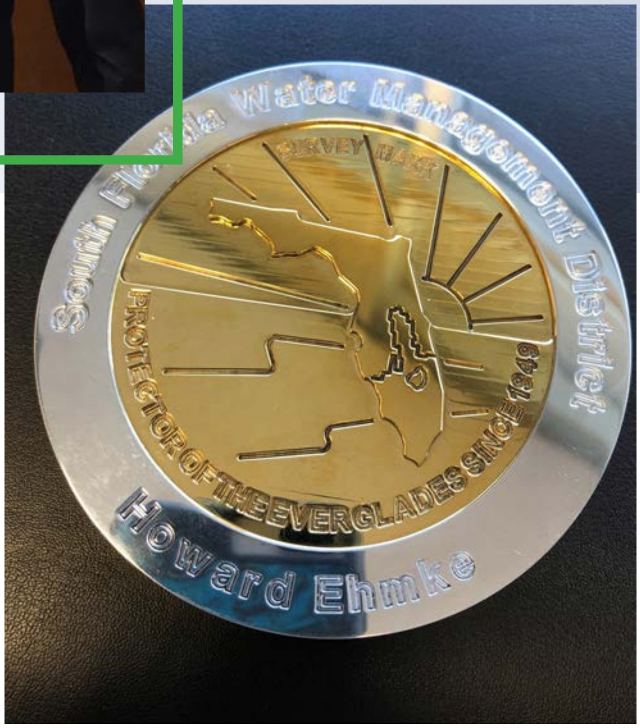
FSMS SHOUT OUT

45-Year Service Recognition: Howard Ehmke Jr.

Lead Surveyor & Mapper (Supervisor)

Surveying & Mapping Section

Operations, Engineering and Construction Division



CONGRATS TO HOWARD EHMKE FOR 45 YEARS OF SERVICE

In December 1974, Howard began his career with the Central and Southern Florida Flood Control District. Subsequently, the agency became the South Florida Water Management District and the Executive Director held a contest to design a new logo. Howard designed the winning logo, enduring today as the current official District seal. Howard has successfully managed various projects, many having regional and statewide impact such as, the River of Grass project, land acquisitions for the Kissimmee Chain of Lakes, CERP NAVD88 Geodetic Vertical Control. Today, he manages the most complicated and challenging surveying tasks due to his many years of experience, attention to detail and outstanding organizational skills. Throughout the years Howard has channeled his expertise and knowledge in efforts to create a database of survey and other records. The repository holds thousands of surveys, records and maps dating back to the creation of the District, all located and updated in an easy to access format, available to internal and external customers. Howard's archiving efforts have proven to provide the District with a host of cost saving measures, reducing countless hours of research and records retrieval time. Highly respected throughout the surveying profession, Howard has served on the regulatory level with the Florida Board of Professional Surveyors & Mappers as Chair and Vice Chair. He was appointed by then Governor Charlie Crist and reappointed for a second term by Agriculture Commissioner Adam Putnam. Howard also served his profession with the Florida Surveying & Mapping Society as Chair of the Surveying & Mapping Council, District Director and President of the Indian River Chapter, for which he has received various service recognitions. On a side note, Howard's great uncle pitched in the 1929 World Series and set a strikeout record that stood for many years. Congratulations, Howard, for 45 years of public service and on your numerous successes through the years to routinely hit it out of the park!

Submission courtesy of: Michael O'Brien
South Florida Water Management District,
Surveying and Mapping Section


Photo by: Brandon Mowinkel

This month's article will follow a theme, I am sure, regarding legislation and how it is going to impact the profession of surveying, and the licensure thereof. I have heard many arguments on whether the change is needed or not, or if we will have the adequate numbers to continue being a profession as it stands. Well one thing is for certain, without the education requirement we are not going to be a profession, based on Florida case law involving what it takes to be considered a professional. I am looking at this from two main perspectives, one protecting the public and the other what does it mean to be a land surveyor.

The profession, as what it is known to be a surveyor has changed over time, we are no longer the profession where you needed a chainman and a large crew. This has morphed to being the crew of only one and two members on a field crew. They are using total stations, RTK equipment, drones and mobile lidar. Does that mean with only four years of responsible charge we should be out there performing our own surveys as the legislation suggests, hell no! I had twelve years experience before I received my license, and I am thankful for my education and experience that enabled me to get it. The profession has changed drastically in the past decade and requires so much more knowledge and experience to be able to perform any type of survey as denoted in Chapter 472 Florida Statutes. The knowledge and experience it takes to properly run out a section or run out a block and weigh out the importance of monumention recovered and order in which it should be held takes time to understand. Four years of experience as proposed is absurd!

I discuss these things in the Surveyors in Government article because we are the ones who will be observing the repercussions of these changes first hand, if they are enacted. We see enough issues from surveyors who have to have their hands held through the development process, where we explain the same issues time and time again. It worries me that some of these individuals will be the sole guidance for educating the next round of surveyors. As I most always state, there are a large number of really good surveyors out there, but there are a number of surveyors who I wonder how they ever were able to get their license. I must preference this is my own opinion and not that of the organization I work for, and that these are my own experiences and opinions. Hopefully most government surveyors do not experience this, but I often hear from my fellow government surveyors the same issues.

SURVEYORS IN government

By: Richard Allen, PSM, CFM

A thing about government positions is that almost all of them require a college degree. We have administrative assistants that require an associate's degree. Every professional position is by far a bachelor's degree, with most having master's degrees. If the current legislation is enacted, the state won't even require a high school diploma, for what, more surveyors? If we are not educated and proficient, why does it matter how many there are of us? Would it matter if there are greater numbers of uneducated tradesmen? I have known great surveyors from every facet and education level, some with a degree and some without. This does not demean them in any way, the profession is changing, we are beyond learning on the job from one licensed individual, the profession is so broad ranging where you have to gain knowledge from multiple subjects. We all should be continually learning, I know I am. I am in school now and learning new things because of it. An item of note, for the City of Orlando you must have a high school diploma for ANY position in the organization.

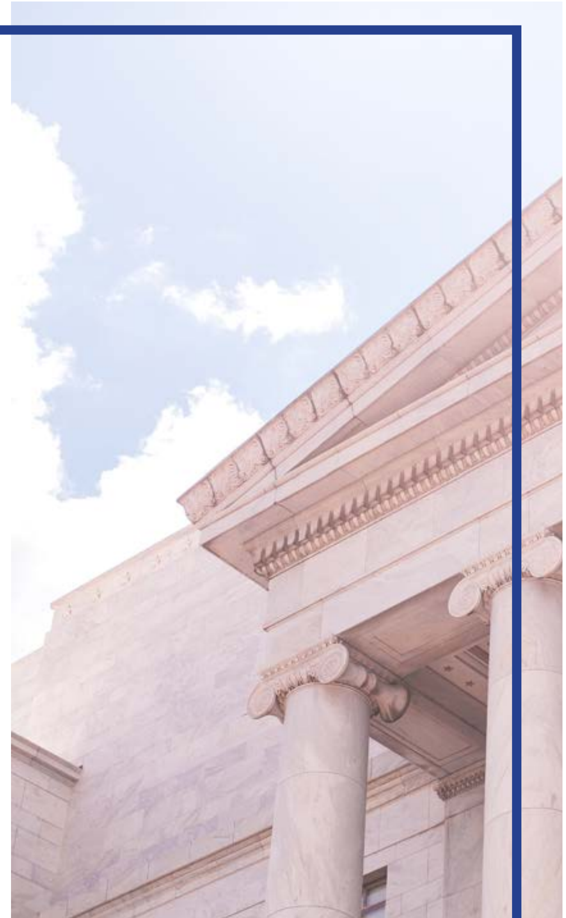


Photo by: Katie Moum

Wherever you stand on this issue, hopefully you are against the bill as it is currently written. I am sure most, if not all of us are proud of the profession you work in and represent. I love the profession and couldn't imagine my life any other way, unless I win the Powerball one day. Then I will donate money to the profession and be an outside observer. Otherwise I am in it and I want to be a part of the storied profession, one that harkens to very established individuals who came before us, most I would have to say were highly educated! Stand up for your profession and make a difference, if not for yourself, at least for the public, in which we are entrusted to protect!

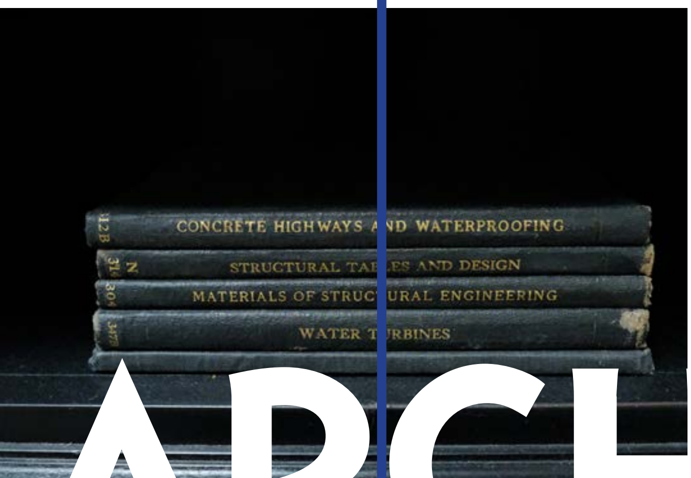
I will get down from my soapbox for now, but I hope we continue to be a part of profession and not a trade. If I wanted to be a part of a trade, I would have learned HVAC or plumbing and not surveying! Until next time my friends.

Sincerely,
Richard Allen
You can reach me at Richard.Allen@orlando.gov or 407.246.2788.

> "I have known great surveyors from every facet and education level, some with a degree and some without. This does not demean them in any way, the profession is changing..."
>
> RICHARD ALLEN, PSM, CFM

FROM THE

ARCHIVES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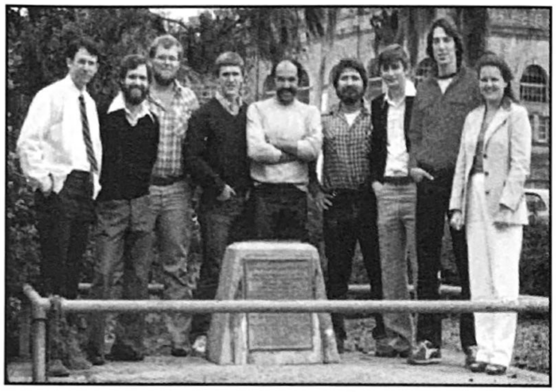
1978-1982
A Student Looks Back

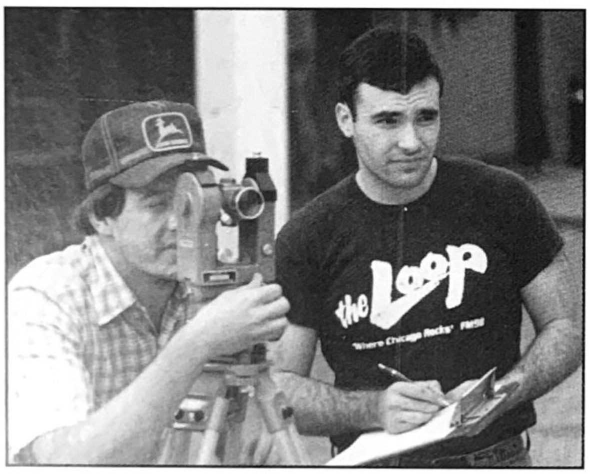
by Jack Breed, BLS, 1982



This is the Senior "Practice" Class field trip to the original monument in Tallahassee. L to R: David Gibson, George Massey, Jack Breed, Bryan Short, Ahmad Poudratchi, Mickey Myer, John Waby, Eric Perser, and Dodie Keith (now Lazowick).

Every year, the Florida Surveying and Mapping Society hosts the University of Florida's Alumni reunion in conjunction with the Society's Annual Conference. It is a great time for the former students (and now active FSMS members) to gather together for fun, fellowship and remembrances. At the Tradewinds Convention this past August, there was a large group of students from the last classes of the 70's and the first classes of the 80's. These Surveyors were among the first 50 in Florida to achieve a Bachelor of Land Surveying degree. When they first enrolled, the degree was entitled Bachelor of Engineering Technology, and shortly after they graduated with a BLS degree, the program changed to Surveying and Mapping (now Geomatics).

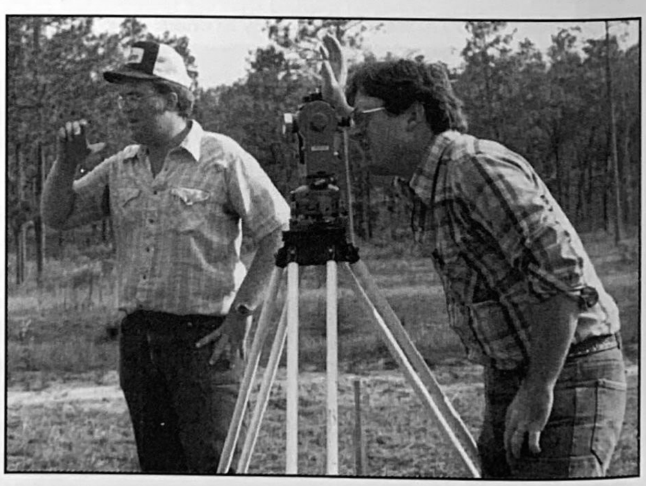
Faced with an unknown degree, these Surveyors began their careers in the recession years of the early 80's. What a contrast to today's highly compensated and heavily recruited graduates! It took a little bit of digging, and several phone calls to identify all the faces, but I hope you enjoy some student photos of this period.



Jeff Cory (at the instrument) and Chris Dosev working on a field lab.

1999 Convention at the Tradewinds. These surveyors were among the first 50 in Florida to achieve a Bachelor of Land Surveying degree.

North Central Florida Chapter Picnic and Surveyors Olympics, Lake Kerr. L to R: Robert Wigglesworth, unknown, unknown, Jack Breed, Tom Zeff, Phil Ghiotto



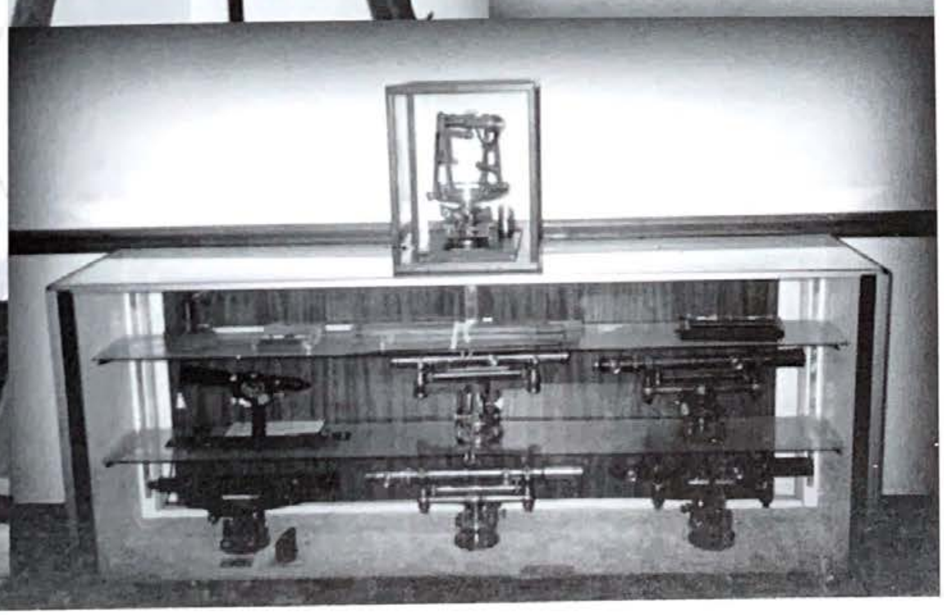
Fall 1981. Photogrammetry Class Field Lab. Putnam County. Jack Breed and John Clyatt (at instrument).

ABOUT OLD THINGS . . .

FSMS has been the recipient of a variety of historical donations through the years and we have a room designated at the Administrative Office for their display. We are appreciative of the generous donations by individuals and the donations of antique equipment by companies such as Allen Precision, Florida Level & Transit and Lengemann of Florida.

If you have historical items that would be of interest to others we invite you to donate them to FSMS for our museum. If you would like to make a monetary donation to assist with the framing of pictures, purchase of display cases, etc. we would appreciate that also.

Help our Museum Room g . . . . . . r . . . . . . o . . . . . . w!



WHAT DEFINES SURVEYING & MAPPING as a Florida profession?

By: Don Elder, PSM, GISP

For many surveyors and mappers in Florida, the origins of the 4-year degree requirement for licensure are not well known. In this writing, I'd like to provide that backstory.

In 1992 the Florida Supreme Court heard a case called Garden v. Frier (602 So. 2d 1273) which became a landmark ruling for Florida's definition of a profession. This case centered around the question of whether a professional malpractice suit could be brought against a licensed land surveyor under the provisions of Florida Statute 95.11(4)(a). This portion of the statute requires that lawsuits for professional malpractice (other than medical) must be brought within 2 years from the time of discovery.

The outcome of this case is easiest to describe by simply quoting a portion of the written ruling (added emphasis is mine).

"...the only relevant criteria for determining if a vocation is a profession are those applicable to first-time applicants who have never been licensed in another state or nation to practice the particular vocation in question. The fact that persons can be licensed in Florida because they hold a similar license in another state or nation is irrelevant, no matter what educational requirements the other state or nation imposes. We do not believe that the definition of "profession" and "professional" should hinge on the licensing provisions of jurisdictions outside Florida, even if Florida recognizes some form of reciprocal licensing.

Moreover, the fact that some members of the vocation may have been admitted at a time when college degrees were not needed has no bearing, nor are the persons previously so admitted considered nonprofessionals. A profession comes into being for present purposes on the date the appropriate licensing body requires a four-year college degree or a graduate degree of all future admittees; and ***a profession ceases to exist*** *on the date that any future admittees no longer need hold either a four-year undergraduate degree or a graduate degree.*
In the same vein, ***a vocation is not a profession if there is any alternative method*** *of admission that omits a required four-year undergraduate degree or a graduate degree."*

This case has been consistently reaffirmed and widely cited in the years since the ruling. Garden v. Frier holds a unique position for Florida surveyors and mappers as it has ripened into a bedrock precedent which pertains directly to surveying.

Currently, a video of some of the arguments in the case is available here, for those who have an interest: https://vimeo.com/173801753

I would encourage anyone involved in the profession of surveying and mapping to read the case ruling in its entirety for themselves. Surveying is much more than just measuring and mathematics; a surveyor must also understand the rules of evidence along with legal precedents in order to competently practice.

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INVESTIGATING EFFICIENCY & ACCURACY of tilt-compensating GNSS Instruments

By: Mariano Mijares, UF Geomatics Senior Project
Advisor: Adam Benjamin

Abstract

The purpose of this study is to evaluate how emerging GNSS technologies can benefit land surveyors working in the field. The goal is to collect data with a tilt-compensated GNSS receiver to determine whether this technology improves efficiency and accuracy.

Introduction

Surveying Practices

The foundation of quality surveying and mapping work is the accuracy and precision of data collection in the field. Professional surveyors and mappers (PSMs) are responsible for: a) measuring angles and distances of points on the surface of earth and b) subsequently interpreting these field collected measurements. Thus, minimizing errors through strict precision and accuracy field measurement protocols is critical. For example, on Florida Department of Transportation (FDOT) projects, the FDOT surveying and mapping handbook appendix C (FDOT, 2019) provides accuracy requirements that need to be met to work within the standards of practice to produce high quality work critical to public safety on large infrastructure projects.

Global Navigation Satellite Systems (GNSS)

There are four major GNSS in operation: GLONASS, GPS, Beidou, and Galileo. The control segment for these systems are operated by Russia, United States, China, and European Union respectively (Sickle, 2008).

As of February 2019, the GLONASS system had 26 satellites (24 operational) in the constellation, the GPS system had 32 satellites (31 operational) in the constellation, the Beidou system had 38 satellites (17 operational) in the constellation (Information and Analysis Center for Positioning, Navigation and Timing, 2019), and the Galileo system had 26 satellites (18 operational) in the constellation (European GNSS Service Center, 2019).

For the user segment, multiple active satellite constellations mean greater coverage and availability for PSMs to use GNSS for geodetic positioning. This leads to more reliable and less time-consuming surveying operations. The user segment consists of a GNSS operator using a GNSS receiver/antenna to collect raw GNSS satellite signals. Through measurement of precise ranges between individual satellites and the receiver, the user can determine the position of the receiver on the surface of the Earth. GNSS equipment are used to collect, locate, and layout data in the field to be later interpreted in the computer as a CAD drawing or as paper plans. The ability to collect measurements in a fast and accurate manner makes the implementation of Real-Time Kinematic (RTK), a favorite method of surveying for the professionals on the field. RTK output can provide immediate results and accuracies similar to that of optical surveying with an electronic distance measuring (EDM) and level (Sickle, 2008).

GNSS Error Sources

Due to greater satellite coverage, the implementations of GNSS in land surveying is common among field technicians. Unfortunately, GNSS users still have to face obstacles when using this technology. Multipath interference (i.e., non-line-of-sight (NLOS) reception) is a major error source when using GNSS in urban environments (Hsu, Jan, Groves, & Kubo, 2015).

Multipath means the signal being received is taking multiple paths instead of a direct line of sight. Multipath occurs when part of the signal from the satellite reaches the receiver after one or more reflections from the ground, a building, or another object (Sickle, 2008). High density forest can also affect the data collection process as the satellite signals get dispersed by the vegetation. Forest and jungle canopy are known to scatter and reflect signals used by many of the technologies we depend on (Wright, Wilkinson, & Cropper, 2017). Human and instrumental error are other sources of discrepancies added to the previously mentioned. Human errors can be caused by limitations of the human senses (i.e., holding the rod slightly out of plumb), while instrumental errors result from imperfections in the construction or adjustment of the instrument and from the movement of individual parts (Wolf & Ghilani, 2006).

GNSS Advancements

As GNSS technology becomes ubiquitous in surveying and mapping, manufacturers continue to look for ways to reduce the sources of error and increase the level of efficiency. With the help of technology advancements, measurements can be now estimated to the nearest hundredth of a foot. RTK accuracy can be characterized using rover-base distances (e.g., σ=1.0 cm + 0.5 ppm) (Feng & Wang, 2008). This means that a baseline of 20 km would have a precision of 1.0 cm due to the instrument precision and an additional 2.0 cm due to the distance between the base station and the rover. To reduce human error related to equipment setup, a couple manufacturers have introduced tilt-compensating GNSS receivers to the marketplace. GNSS receivers are positioned at the top of a rod and must be leveled with a bubble plumb to relate the data on the ground to the receiver (Luo, Schaufler, Carrera, & Celebi, 2018).

The latest advancement in GNSS data collection is tilt-compensation into the GNSS receiver using inertial navigation system (INS) sensors. INS sensors measure the orientation and velocity of a moving object by using an internal Inertial Measurement Unit (IMU) which is composed of gyroscopes to measure rotation and accelerometers to measure motion (Barbour, Elwell, & Setterlund, 2006). Thereby, the need to level the GNSS receiver prior to data collection is unnecessary. In theory, this makes the job of data collection easier by reducing one of the human error sources and should be less time consuming.

GNSS/INS Integration & Errors

Unlike magnetic compasses used for heading determination, INS are independent of external electromagnetic signals and can process data at high rates (several hundred Hz) while GNSS receivers typically update position and velocity at lesser rates (1 to 20 Hz) (Angrisanoet al., 2010). This makes their integration very useful for vehicle navigation by keeping an updated location even when satellite visibility is highly reduced. A common configuration for positioning trajectory determination includes a GNSS receiver and a high-end INS capable of providing navigation solutions during GPS gaps (Angrisano et al., 2010). GNSS and INS systems complement each other in the following ways. INS errors are short-term small errors that degrade rapidly, needing external bounding (Angrisano et al., 2010). On the other hand, GNSS provide a more stable, long-term error solution with no time variation; therefore, GNSS can be used to bound INS errors (Angrisano et al., 2010). Meanwhile, INS provide positioning when GNSS experiences an outage. Finally, INS systems provide the complete navigation state, including position, velocity and attitude while a single GNSS receiver cannot supply angular information (Angrisano et al., 2010).

Tilt-compensation GNSS systems that integrate INS offer an opportunity to improve productivity and user experience. Benefiting from the tilt compensation technology that automatically adjusts pole tilt from plumb, GNSS RTK can now be applied in more restrictive situations with enhanced efficiency and flexibility (Luo et al., 2018)

Objective

The objective of this study is to test the efficiency and accuracy of this tilt-compensation GNSS technology under varying field conditions. The goal is to understand the limitations of the technology and the best practices for obtaining optimal results. Thus far, the authors are only aware of manufacturer-produced literature related to this technology. This project will serve as an independent check on the manufacturer's work and provide greater confidence to the PSM community on the adoption of this technology.

Materials & Methods

Study Site

The study site for this project is the University of Florida Fort Lauderdale Research and Education Center (UF FLREC) in Davie, Florida as shown in Figure 1. FLREC Geomatics staff provided permanent project control point (PCP) locations distributed throughout FLREC for the accuracy analysis. Additionally, two parking lots were chosen as the testing sites for timed GNSS data gathering. The Broward County Extension parking lot (BCEPL) and the greenhouse parking lot (GHPL) are shown in Figure 2 and Figure 3, respectively.

The UF FLREC provides a mixture of urban and suburban environments with buildings of various heights (1 to 4 stories), moderate tree densities, and mild topographic variation. Since FLREC provides conditions typically encountered by South Florida land surveying businesses, the study site provides an environment suitable for gathering data for the experiment.

Equipment

GNSS/INS Receivers

There were two primary GNSS receivers tested in this project. The first is the Leica GS18T, which is the latest release from Leica Geosystems. The GS18T is a GNSS receiver with an upgraded hardware that makes it capable of tilt compensation. Unlike magnetic tilt compensation, the GS18T uses an inertial measurement unit (IMU) to locate the antenna in a 3D space while computing for the location of the rod's tip. The tilt compensation solution of the Leica GS18T utilizes precise IMU measurements from industrial-grade micro-electro-mechanical sensors (MEMS), which are especially appropriate for surveying applications. The second GNSS receiver, a Leica viva GS14, was a traditional GNSS receiver that required rod leveling. This receiver provided the basis of comparison to the GS18T. The GS14 model was released prior to the GS18T. It is not equipped with an INS, so it does not compensate for rod tilt. The GS14 will serve as the control antenna for the experiment.

Figure 1 The project site is located at the University of Florida Fort Lauderdale Research and Education Center in Davie, Florida. The yellow stars indicate locations of the smaller test sites and the yellow circles indicate the location of control monuments.

Figure 2 Broward County Extension Parking lot located at the East of the project site, provides a mixture of medium to low density trees. The red star represents one of the control points and the red dots represent the westmost corner of the paint stripe measured.

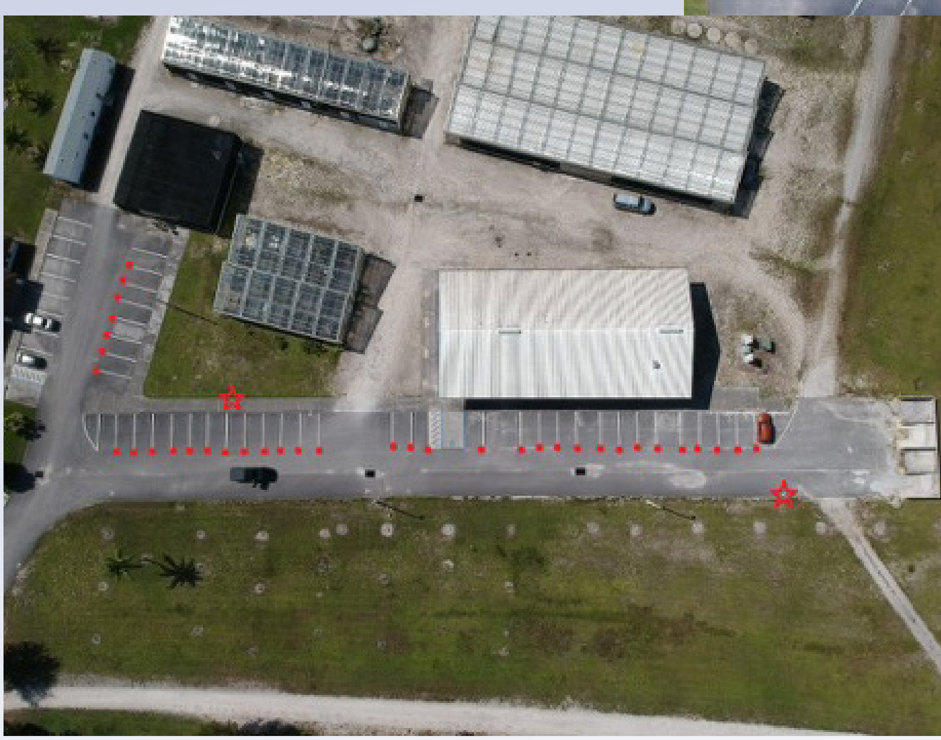

Figure 3 The Green House Parking lot located at the West of the property site. With only a one-story building serving as the main obstruction, this area provided an environment with less tree coverage than Broward County Extension Parking Lot. The red stars indicate the location of control points and the red dots the southmost and the westmost corner of the paint stripe measured.

Total Station

A Leica TS06 total station was used in this experiment to compare measurement accuracies against the GNSS units. The TS06 has a 2 seconds angular accuracy and a +/-(1.5mm + 2ppm x D) horizontal precision. This means that a position measured at 100 meters would have a precision of +/- 1.5mm and an additional 2mm due to the distance.

Field Methods

Multiple control monuments have been set and monitored though the years on FLREC grounds. Project control points (PCPs) were selected as shown in Figure 1 based on an existing conditions assessment and a survey of the environment surrounding each PCP. The goal was to study the performance of the GNSS unit by analyzing GNSS observations under varying environmental surroundings.

The two parking lots in Figure 2 and Figure 3 were chosen as the random sample collection areas because each provide a different environment for data collection. The corners at the end of the parking paint stripes were used to keep the collection constrained to a single feature while providing pre-marked points for repeating the collection process multiple times with different GNSS receivers and total stations. Figure 2 featured an area with prominent tree canopy obstructions while Figure 3 featured a less vegetated area with a 1-story storage building close to the parking area.

Measurements were taken under different tree canopies to assess the ability of the GNSS/INS unit to accurately determine position is signal degraded environments.

Control points DWL and DWN had tree canopies covering only one side of the sky while points collected along BCEPL were directly under tree canopies of various sizes.

An inclinometer was used to measure the tilting angles in the tests. This provided a better understanding of the limitations of the instrument at different tilted angles and directions. This data will be monitored and compared to data collected with a conventional GNSS antenna.

To keep the experiment controlled, measurement parameters were kept the same on both receivers. This includes an elevation mask of 10 degrees and no PDOP restriction. During the collection of PCPs with the GS14, 3 positions were collected on each monumented point. FDOT's Florida Permanent Reference Network (FPRN) was used to obtain RTK corrections using a virtual reference station (VRS) solution. To obtain the first static point, the GNSS receiver was set to reach a measurement precision of 0.025' horizontally. The other two measurements were rapid points. Rapid observations allowed quicker data collection times but with less precision (0.040' horizontally).

	horizontal Regression Assessment		Vertical Regression Assessment	
Variables	*Coefficients*	*P-value*	*Coefficients*	*P-value*
TOTAL TIME (s)	0.0000	0.8897	-0.0004	0.2489
GS14	0.0729	0.0003	-0.0340	0.5271
AM	-0.0468	0.0001	0.2259	$p < 0.0001$
TILT	0.0371	0.0600	-0.3254	0.5891
Adjusted R square	0.26		0.48	

Table 1 Contains the resulting coefficient values, P-values and Adjusted R-squared value of 3 regressions, Northing, Easting and Elevation where n=66. P-values less than 0.05 are significant.

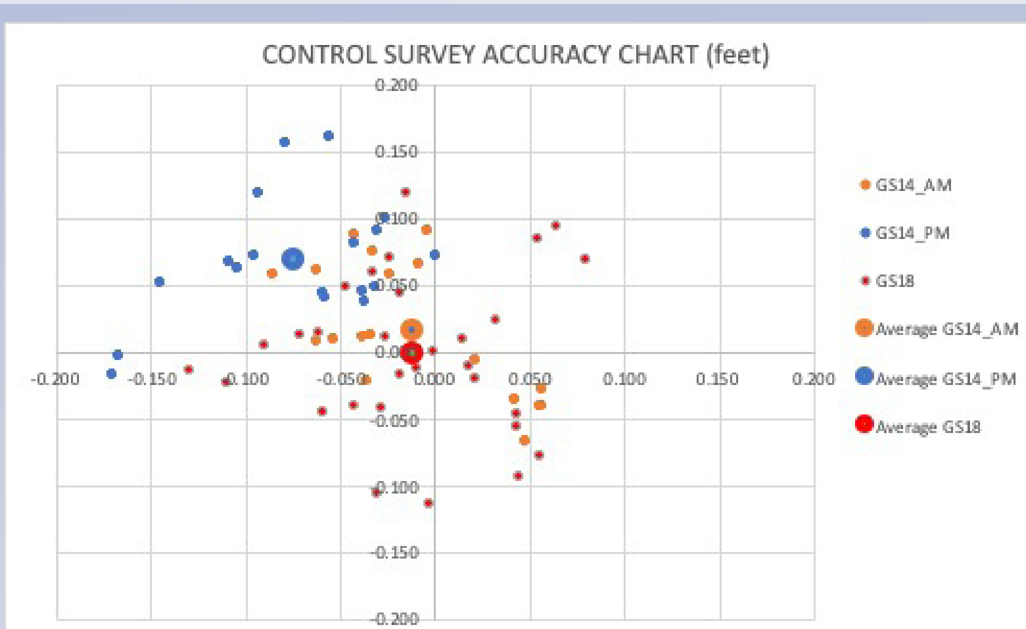

Figure 4 depicts receiver accuracy comparison of Control Survey depicting the horizontal distance, in feet, of surveyed points from the control coordinates. Small color-coded dots represent the points collected with each receiver and the bigger dots represent the average location for each group.

Green House Parking Lot (GHPL) Timed survey								
	ΔGS14				ΔGS18			
	d_N	d_E	d_NE	d_Z	d_N	d_E	d_NE	d_Z
MEAN	0.036	-0.034	0.057	0.258	-0.039	0.010	0.064	0.089
MAX	0.107	0.025	0.117	0.526	0.073	0.069	0.127	0.175
MIN	-0.030	-0.089	0.010	0.123	-0.122	-0.085	0.003	-0.013
	RMSE_Y	RMSE_X	RMSE_YX	RMSE_Z	RMSE_X	RMSE_Y	RMSE_YX	RMSE_Z
	0.047	0.045	0.065	0.272	0.062	0.037	0.073	0.100

Table 2: Green House Parking Lot Timed Survey Data Analysis

For the GHPL site, the measured points were on average 0.057' from the control coordinates when using the GS14, and 0.064' when using the GS18T. Vertical values when compared to the control values, were different by 0.258' for GS14 and 0.089' for the GS18T. RMSE values are similar between the two instruments.

Collection parameters for the GS18T were similar to the GS14 with an added parameter to account for the tilting aspect in the rapid positions of the PCPs. The static observation was done with the instrument plumbed due to the tilting compensation switch that turns off tilting compensation after 25 seconds of zero movement. This compensation switch could not be turned off during the experiment. Thus, more investigation is required to know if this feature can be manually turned off by the user. Four extra points were taken as rapid tilted points at a tilt angle of 20 degrees in each cardinal direction (i.e., North, South, East, West). Parking lots were surveyed with two control points collected at the beginning and the end of the survey to check for any deviation or signal bias (control points were collected with the GS18T plumbed). The rest of the paint marks were collected with rapid observations with the GS14 and rapid/tilted observations with the GS18T, both with a horizontal tolerance of 0.030'. To assess the results of measurements taken with each GNSS receiver, the same locations where measured using a Leica TS06 total station due to its higher degree of accuracy compared to that of a GNSS survey. Measurements taken with the total station were regarded as control measurements in the data analysis.

Results

Data analysis and tools

After each survey, the GNSS point coordinates were output for analysis in Microsoft Excel. Since the GNSS receivers were collecting point data in the field, no post-processing of the kinematic GNSS data was undertaken. Using the regression tool in the Data Analysis Toolpak, data gathered from both receivers in the control survey was assessed to determine which variables (i.e. total time per survey, receiver model, time of the day, and tilting) were significant to the accuracy of each device.

From this data analysis, data gathered in the morning had a significant, inverse relationship with the horizontal distance discrepancies while the use of the GS14 receiver had a significant, direct impact on the horizontal differences. Thus, the use of the GS14 leads to greater distances which means that using the GS18T corresponds to a more accurate GNSS receiver in this experiment. Only data gathered in the morning had a significant, inverse impact on the vertical accuracies. Most importantly, the occupation of points with a tilted orientation did not have a significant, adverse impact on the vertical or horizontal accuracy of the GNSS observations. The difference between the horizontal position of a control coordinate and the measured position for that same point is shown in Figure 4. In this figure, the GS14 PM dataset is the only one that has a substantial bias to the northwest of the known location.

Broward County Extension Parking Lot (BCEPL) Timed survey									
	ΔGS14				ΔGS18				
	d_N	d_E	d_NE	d_Z	d_N	d_E	d_NE	d_Z	
MEAN	-0.028	0.043	0.113	0.300	-0.010	-0.029	0.052	0.036	
MAX	0.063	0.192	0.195	0.548	0.046	0.031	0.106	0.255	
MIN	-0.149	-0.094	0.024	0.146	-0.070	-0.103	0.005	-0.087	
	RMSE_Y	RMSE_X	RMSE_YX	RMSE_Z	RMSE_Y	RMSE_X	RMSE_YX	RMSE_Z	
	0.069	0.099	0.121	0.311	0.084	0.191	0.209	0.407	W/blunder
					RMSE_X	RMSE_Y	RMSE_YX	RMSE_Z	
					0.032	0.047	0.057	0.080	WO/Blunder

Table 3 Broward County Extension Parking Lot Timed Survey Data Analysis. The GS18T portion of the table shows the Mean, Max and Min values without the blunder.

Total Time to Complete Survey		
instrument	GHPL	BCEPL
GS14	17:49	17:20
GS18T	15:39	09:31
TS06	26:01	24:35

Table 4 Show the times it took to survey the selected locations with each instrument.

For the BCEPL site, the measured points were on average 0.113' from the control coordinates as measured from the GS14 and 0.052' as measured from the GS18T. The difference in vertical values from measured data to control coordinates were 0.300' for GS14 and 0.036' for the GS18T. During the data analysis, two blunders were discovered in the collection. The source of these blunders might have been a sudden stop of the tilting-compensator in the middle of the measurement, resulting in the measured locations to be inconsistent with the rest of the data acquired. In Table 3, the RMSE values are shown with both the blunders added into the analysis and without them. RMSE values favor the GS14 group when the blunders are counted in the GS18T data. On the other hand, the GS18T group provided better results without the blunders. Based on these results, there is not a substantial difference in the horizontal or vertical accuracy of the GNSS observations regardless of the receiver used to collect the data. However, there was a significant difference in the time it took to survey both sites as shown in Table 4. The resulting times show the GS18T without the need to plumb the rod was significantly better than the non-tilting GS14 or the TS06 total station.

Conclusions

This experiment was designed to gather information about the GS18T GNSS receiver that could help on deciding whether the implementation of the newer technology can improve the surveying practice. Based on the results of this experiment, the performance of the GS18T substantially improved time efficiency of data collection relative to the GS14 without impacting accuracy of the observations. This was accomplished because the GS18T provided the ability to work without plumbing the instrument when collecting rapid observations. This had a twofold effect by a) increasing the speed of data collection and b) providing the ability to avoid possible obstructions or hazards at the time of survey.

Field Observations

Working with the GS18T in the field allowed one to experience the behavior of the unit first-hand. In this experiment, a couple of observations that stood out when using the receiver were the tilting actuation angles and movement. The device shuts on and off the tilting correction automatically. It was observed that the tilting corrections were on when the device was affected by movement (walking or swinging the device from one side to the other). The tilting correction turned off when the device stood still for more than 25 seconds. This meant that points that required extra precision (longer collection times) had to be plumbed and could not be collected while having the device tilted.

Project Beneficiaries

A surveying company that is looking to get a new GNSS receiver can use this data as a reference to determine whether the new technology will provide the results they are looking for and if it is worth the investment.

Future Project Improvements

In order to obtain more information about the impact of using the GNSS/INS receiver the experiment can be conducted at a different location with other kinds of obstructions and at different times of the day.

Surveying an area close to a multi-story building can assess the impact of multipath by using the tilting feature of the receiver to tilt the antenna away from the obstruction. Adding more parameters to the observations such as exact time of collection, constellations observed, or satellite geometry (dilution of precision). More detailed forest canopy metrics (e.g. tree type, tree canopy, density) can also be considered. Further, a site calibration can be done to improve the accuracy of the measurements, especially vertical accuracy when using network RTK.

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Acknowledgements

I would like to thank FLT Geosystems for making the Leica GS18T available for this experiment and being supportive of this research project. Thank you to Samuel Martinucci, who assisted with instrument operation during the data collection.

I would also like to thank J. Hernandez and Associates Inc. (J.H.A.) for providing the remaining survey equipment needed for data acquisition as well as transportation to the project site.

Lastly, thank you to Adam Benjamin, whose advice and guidance was present throughout the entire process of making this project possible.

Around the State

Charlotte Harbor Chapter
December 2019

1. We thanked Ralph Rhodes for being our director with a fine bottle of spirits.

2. Ralph installing new officers (L-R), Lea Shremshock, secretary; Dave Shremshock, vp; Derek Miller, pres.; Michael Pezanetti, treasurer.

3. Passing the gavel to President Miller.

Photos submitted by: Greg Rieth

Dodie Keith recognized in December 2019 as the South Florida Business Leader of the Year 2019 by Seafarers House at Port Everglades.

Photo by: Grant Fichter

Seminole Tribe survey marker recovered while performing a control survey for FDOT in Immokalee.

Photo courtesy of: Michael O'Brien
South Florida Water Management District,
Surveying and Mapping Section

THE SURVEYOR

He thrives on patterns,
his marks and monuments
transforms a wilderness
and by his carefully tagged
and numbered squares,
neat roads, correction lines
and Small Cadastral lots
he clothes in certainty,
in geometrical designs,
man's ancient Rights.
He scans the skies,
reading some far-off star
by which he plots
meridians and makes his maps,
stitching a new found world
into a patchwork quilt,
a net of metes and bounds
so lands may know their own
and live in peace.

By Don W. Thomson

Thanks to Chappy Young for this submission.

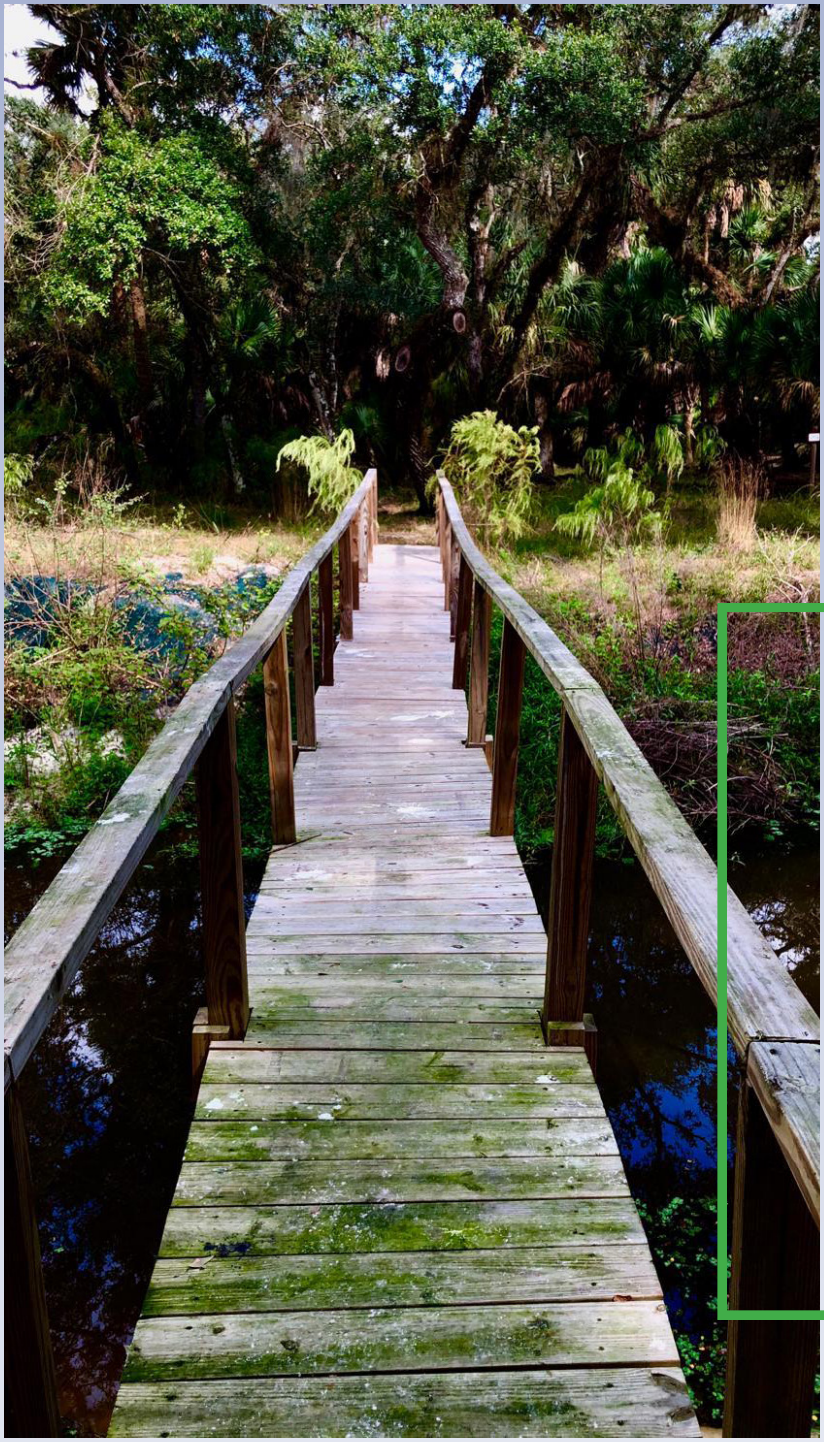
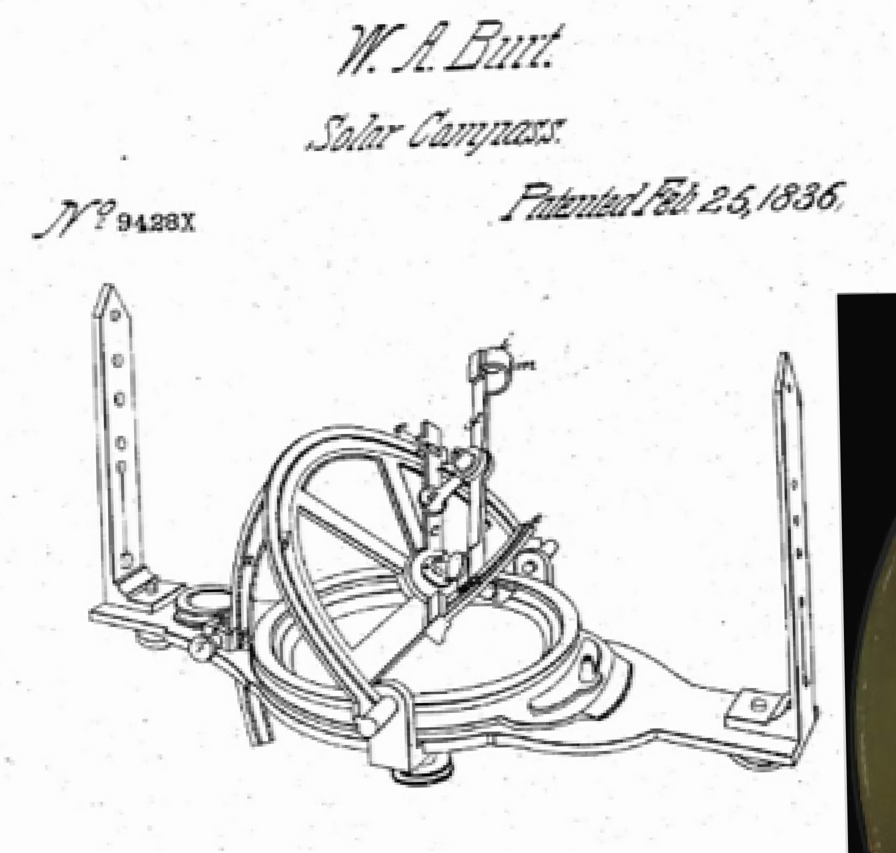


Photo courtesy of: Michael O'Brien
South Florida Water Management District,
Surveying and Mapping Section


W. A. Burt.
Solar Compass.
No 9428X
Patented Feb. 25, 1836.


ALABAMA
GEORGIA
Tallahassee
Latitude 30° N
ATLANTIC OCEAN
Gulf of Mexico
Latitude 27° N

BURT'S SOLAR COMPASS
& determining true north in Florida

Photos & Text by: Bob Heggan, Jr., PSM, PLS

William Austin Burt was born in Petershan, Massachusetts in 1792 and his family moved to Erie County in New York in 1802. He possessed a fond affection for navigation and astronomy aspiring to be the master of a ship one day. By studying traverse tables and methods by which to determine latitude, along with constructing his own quadrant, he was able to ascertain the latitude of his father's farm with reasonable certainty. At age 16, his father sent him to school for 6 weeks to learn science and mathematics. His mother discouraged him from being a ship's master, so at 18 he bought a broken surveying compass, repaired it and proceeded to survey his father's farm.

Following the War of 1812, he married and took up various positions in the local government including County Surveyor. His principal occupation was a millwright. Burt traveled about from 1817 through 1822 until he settled in Michigan, near Detroit. He continued his work as a millwright until 1833 when he was appointed a U.S. Deputy Surveyor.

> "By studying traverse tables and methods by which to determine latitude, along with constructing his own quadrant, he was able to ascertain the latitude of his father's farm with reasonable certainty."
>
> BOB HEGGAN, JR., PSM, PLS

While being a U.S. Deputy Surveyor General, he received a patent in 1836 for one of the most revolutionary surveying instruments of the century; the variation compass. Plagued by the large number of iron ore deposits in northern Michigan, this instrument enabled the user to determine true north without the aid of the magnetic needle by using the Sun.
With the assistance of instrument maker William J. Young of Philadelphia, Burt developed the prototype for the variation compass which was attached to a traditional vernier compass. The variation compass was a commercial failure mainly since you could only accurately run lines north and south; not east and west.

Burt and Young went back to the drawing board to make improvements to the variation compass and in 1840 developed the first prototype for what was to be known as the solar compass. Less than 50 were made prior to 1852 and Burt's patent expired in 1850 and Congress would not renew it. Young continued to manufacture solar compasses with modifications and improvements, but other makers soon followed suit.

In 1855, when the Commissioner of the General Land Office required the use of solar compasses on all surveys in areas where the magnetic needles may be compromised. It became the "gold standard" for the surveying of public land. This created an explosion in the production of the solar compass and W & L. E. Gurley soon emerged to be the leading manufacturer of these instruments.

In 1857, William Austin Burt died in Mt. Vernon, Michigan at age 65. His legacy of inventions included the typewriter, the solar compass and the equatorial sextant.

While there were many improvements to the solar compass over the years, the basic concept remained unchanged and it was widely used in the surveying of the western United States up into the early 20th century.

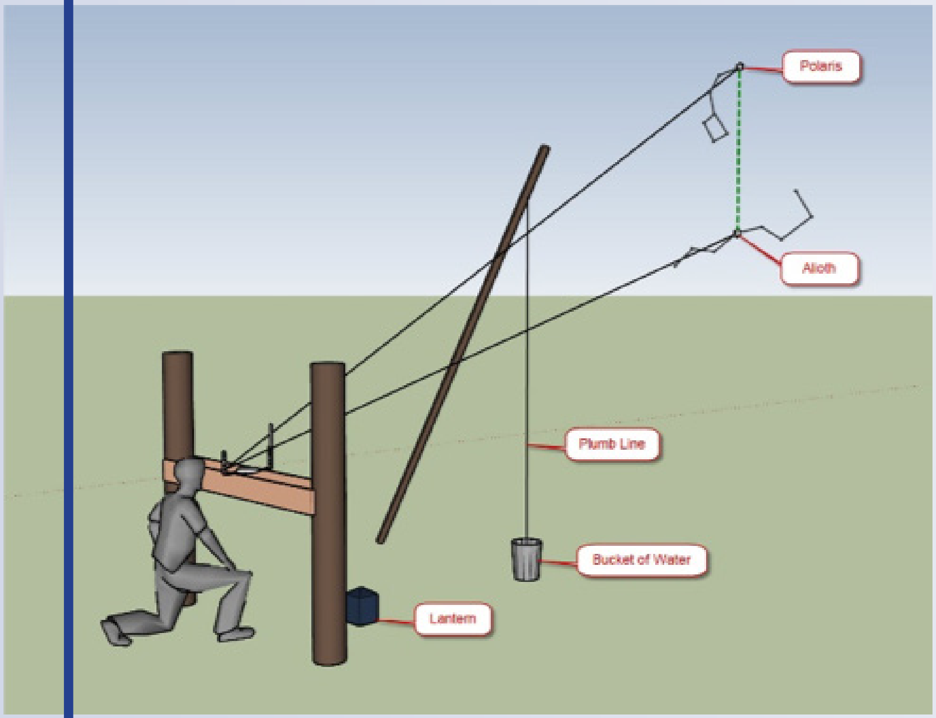
While the solar compass was a staple of public lands surveying, it does not appear to have been used in Florida. When Florida gained statehood in 1845, the solar compass was only being used in Michigan and some surrounding areas. By the time the Commissioner of the General Land Office mandated its use, all of the lines for the townships in Florida were set with only less than 5% (estimated) of the interior sections to be run.

A great number of the remaining interior lines were not run until later due to the dangers posed by the native Americans.

One of the fundamental flaws with the early solar compasses was that the minimum latitude on the latitude arc was 30 degrees with the maximum at around 53 degrees. This meant that anything just south of Tallahassee could not be surveyed with the solar compass while providing for a sizable area of Canada above the 49th Parallel. Improvements after 1853 expanded the latitude arc to 27 degrees by flipping the vernier scale the opposite direction but this would limit surveys to just north of Charlotte County leaving the bulk of the un-surveyed sections to the south. This could be remedied by making observations for latitude daily at noon, but no significant progress could be achieved beyond a mile. While Burt claimed in an 1841 letter that suggested improvements to the solar compass that would allow for observing "any fixed star within 25 degrees north of the equator." Although made this claim, it appears that Young's models in the late 1840 looked to appeal to the growing market in the north central states and even Canada where magnetic disturbances were more common.

In retrospect, true north in Florida was most likely determined by methods commonly found in the surveying texts of the period. One such text, Gummere's Treatise on Surveying, gives a procedure by which one is to make observations to determine the variation of the needle as shown in the figure below.

A compass would be placed on two level boards that would allow the compass to be slid and twisted. Ahead of the compass a pole 16 feet in length was planted to suspend a plumb line that was dampened in a bucket of water and front lit by a shielded candle. The compass would then be positioned to align with a plumb line and Polaris thus pointing true north and the variation noted. Some text even went as far as recommending the observation be made at the time that Alioth was directly below Polaris allowing for the maximum elongation. Unfortunately, the procedure was quite tedious and would most likely discouraged observations on a regular basis.



To conclude, all section lines run have their inherent problems, especially when original monumentation has been obliterated. It is evident that most of the inaccuracies of the lines in Florida were due largely to insufficient instrumentation, a problem that plagued surveys prior to 1855. While Burt's solar compass arrived too late and was unsuitable for use in Florida, it may have improved the accuracy of those original surveys. To learn more about Burt's Solar Compass please visit compleatsurveyor.com to view a variety of instruments as well as a step by step breakdown of its use.

Robert Heggan Jr. is the City Surveyor for the City of Sarasota (FL). He is a subject matter expert on early surveying methods as they impact boundary retracement. Bob served as a Deputy Surveyor General for the Province of West New Jersey, one of the oldest provincial governments still known to exist in the original colonies. He is an avid collector of early surveying instruments, books and ephemera and specializes in instruments made primarily in Philadelphia.

DID YOU EVER WONDER WHY??

By: Michael Whitling, PSM

¿¿ WHY WONDER EVER YOU DID

Why is hurricane, tornado, typhoon and blizzard used as names for big storms?

There are two plausible theories as to the word "hurricane" so I'll let you decide. The first theory is "hurricane" was derived from the Spanish word 'huracán', the origin of which is the Caribbean term for "God of Evil." The second theory comes from the name of the Mayan storm god, 'Hurakan' who spread his breath through the turbulent waters at the beginning of the creation of the Earth.

"Tornado" is an altered form of the Spanish word tronada, which means "thunderstorm" which was taken from the Latin tonare, meaning "to thunder". The modern spelling, "tornado" was additionally influenced by the Spanish word tornar, meaning to twist.

The history of "typhoon" presents a perfect example of the long journey that many words made in coming to English. It traveled from Greece to Arabia to India, (also rose independently in China), before assuming its current form in our language. The Greek word 'tuphon,' used both as the name of the father of the winds and a common noun meaning 'whirlwind', was borrowed into Arabic during the Middle Ages as 'tufan." In the late 1500's it passed into English from the India version of the word 'touffon.' Meanwhile, the Chinese had their own word 'taaifung', meaning great wind. In the 1800's these various forms combined to finally become "typhoon."

The origin of "blizzard" in the sense of snowstorm remains somewhat mysterious, but the evidence suggests that the word had appeared in newspapers across the nation as a slang term for; a heavy or painful physical blow, a blast or volley from firearms or cannons, a blazing fire, a shot of whiskey and a verbal assault. In the late 1800's, someone used it to describe a strong winter storm with driving snow and it stuck.

Why are the wedges used under wheels of airplanes called "chalks?"

On a recent flight I heard the word "chalks" used and of course it got me wondering where it came from. A "chock" is a wedge of wood or metal that you place behind a wheel to keep a vehicle from rolling. Simply enough, the word's original meaning was 'lumpy piece of wood,' from Old North French 'choque,' or 'block.' Then there's that other "chalk" that we used on blackboards and sidewalks, from the old English 'cealc', meaning soft white limestone, lime or plaster. Chalk (calcium carbonate) has been found in cave paintings that date back to 40,000 BC, while gypsum (calcium sulfate) has been used as a mortar for construction since the dawn of civilization, and is even found in the Egyptian pyramids. I mention gypsum because, most chalk today isn't technically chalk at all, but gypsum!

Why do we call our parents "mom" and "dad?"

The words can be traced back to the 1500's for "dad" and the 1800's for "mom". Where these words were first uttered and by whom is a mystery. In fact, the Oxford English Dictionary has admitted that they have "no evidence" on where the word "dad" originated. Some speculation says it comes from 'dada,' one of the words a baby can say consistently. The word "mom", on the other hand, is a slightly different story and it's widely believed that the word was born from the much older word "mamma" which itself can be traced back to the 1500's in English. This, in turn, can be traced back to Latin where "mamma" meant "breast" or "teat". From this word, we also got the word "mammalia" and later "mammal" to describe animals that suckle their young. Amazingly, a word extremely similar to "mom" occurs in almost every language on Earth. For example, if you wanted to address your mother in Dutch you'd say "moeder", if you were to travel to Germany you'd call her "mutter", while over in Italy you'd refer to her as, "madre". Other examples include; Chinese: Mãma, Hindi: Mam, Afrikaans: Ma, and Swahili: Mama.

Quick Facts:

The oldest dog reliably documented was an Australian cattle dog named Bluey. After 29 years and 5 months of faithful service, Bluey was put to rest in 1939.

In 1998, Russian wolfhound Olive Oyl of Grayslake, Illinois, made the Guinness Book of World Records when she skipped rope 63 times in one minute.

Zorba, an Old English mastiff, was the world's heaviest and longest dog ever recorded. Zorba weighed 343 pounds and, from nose to tail, was eight feet three inches long.

Armored knights raised their visors to identify themselves when they rode past their king. This custom has become the modern military salute.

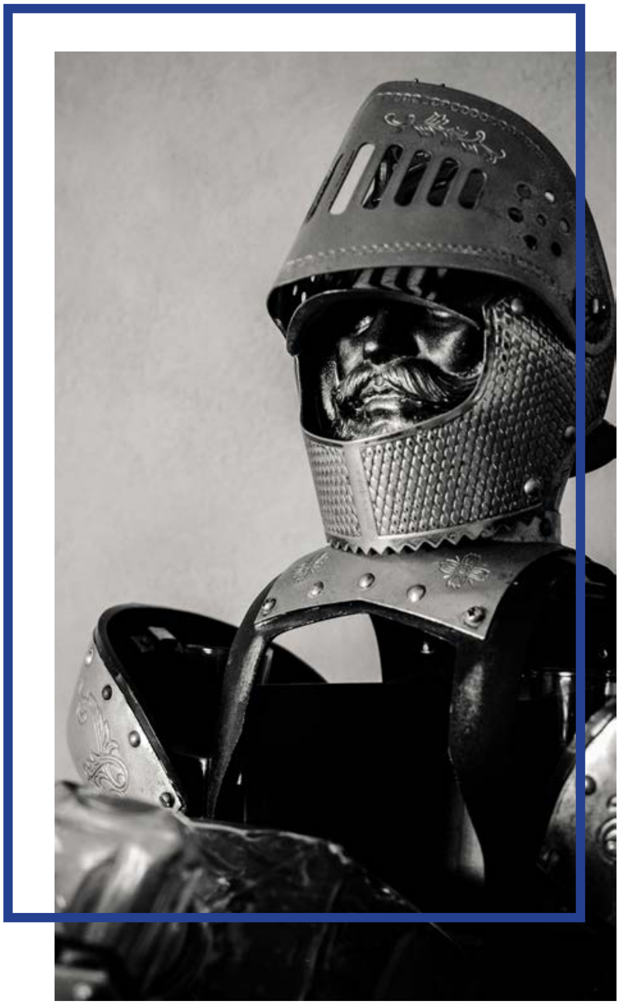


Photo by: Antonino Visalli


Photo by: Bruna Branco

Captain Cook lost 41 of his 98 crew to scurvy (a lack of vitamin C) on his first voyage to the South Pacific in 1768. By 1795 the importance of eating citrus was realized, and lemon juice was issued on all British Navy ships.

During World War II, White Castle sold hot dogs and eggs due to meat rationing.

Inspired by the designs of Greek temples, the Lincoln Memorial features 36 columns representing the number of states in the union at the time of Lincoln's death. The famous seated statue of Lincoln was carved from 28 blocks of white Georgia marble.

The Capitol Building has been the meeting chambers for the Senate and the House of representatives for 200 years. Although burned by the British in the War of 1812, the building was saved from complete destruction by a rain storm dousing the flames. The dome of the Great Rotunda is 180 feet tall, which is also half the length of a football field.

Each type of shark has a different shaped tooth depending on their diet. A shark may grow and use over 20,000 teeth in its lifetime! If one tooth is lost, another spins forward from the rows and rows of backup teeth.

Although the fad didn't take off until the 1970s, the first skateboards were mass-produced back in the 1950s, when the sport was promoted as "sidewalk surfing."

The Motion Picture Academy has awarded nearly 3,000 Oscar statuettes since 1929, and they all have a different number emblazoned on them. Each Oscar statuette stands on a film reel, which has five spokes representing the original branches of the Academy: actors, directors, producers, technicians and writers.

The body creates and kills 15 million red blood cells per second.

False eyelashes were invented by film director D.W. Griffith while he was making the 1916 epic, “Intolerance.” He wanted actress Seena Owen to have lashes that brushed her cheeks.

The word vaccine comes from the Latin word “vacca,” which means cow. This name was chosen because the first vaccination was derived from cowpox which was given to a boy.

The tin can was invented by Peter Durand in 1810. The modern can opener was not invented until 1856. Before the can opener, people used a chisel and hammer to open cans.

Send your thoughts to drmjw@aol.com

Photo by: Sharon McCutcheon

2020 Committees

Standing Committees	
Nominating Committee	Hal Peters
Membership Committee	Dodie Keith-Lazowick
Finance Committee	Bon Dewitt
Executive Committee	Don Elder
Education Committee	Dianne Collins
Annual Meeting Committee	Jim Sullivan
Legal Committee	Jack Breed
Strategic Planning Committee	Hal Peters
Ethics Committee	Joe Perez
Legislative Committee	John Clyatt
Surveying & Mapping Council	Randy Tompkins
Constitution & Resolution Advisory Committee	Eric Stuart

Special Committees	
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Academic Advisory UF	Bon Dewitt
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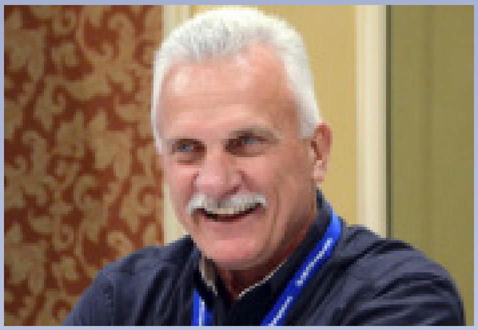
Geospatial Users Group	Matt LaLuzerne

ADMINISTRATIVE staff



Executive Director
Tom Steckler
director@fsms.org

Education Director
Rebecca Culverson
education@fsms.org

Communications Director
Laura Levine
communications@fsms.org

Regional Coordinator
Cathy Campanile
seminolecc84@gmail.com

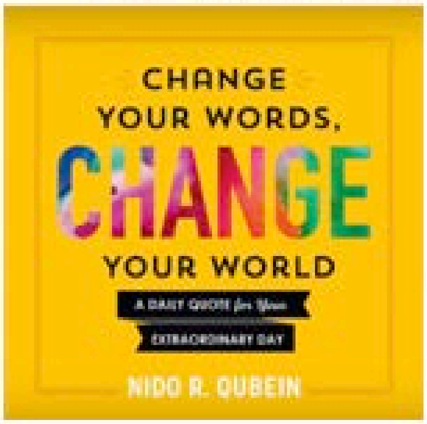
The person who can laugh often and who finds humor in even the most stressful events can keep going when others are falling by the wayside. Learn to look for the humor in every situation- you'll live longer and have a lot more fun.

Share this with others-

From the book-

CHANGE YOUR WORDS, CHANGE YOUR WORLD

A Daily Quote for Your Extraordinary Day



"Sneak A Peek" & Learn More

In *Change Your Words, Change Your World, Nido R. Qubein* offers messages for each day of the year that will spark a new direction and attitude in your life. When you change your words, when you transform your mindset, when you examine your beliefs, you will change your focus and begin to change your world.

The Florida Surveyor is the official publication of the Florida Surveying and Mapping Society, Inc. (FSMS). It is published monthly for the purpose of communicating with the professional surveying community and related professions who are members of FSMS. Our award winning publication informs members eleven months of the year of national, state, and district events and accomplishments as well as articles relevant to the surveying profession. The latest educational offerings are also included.

2020
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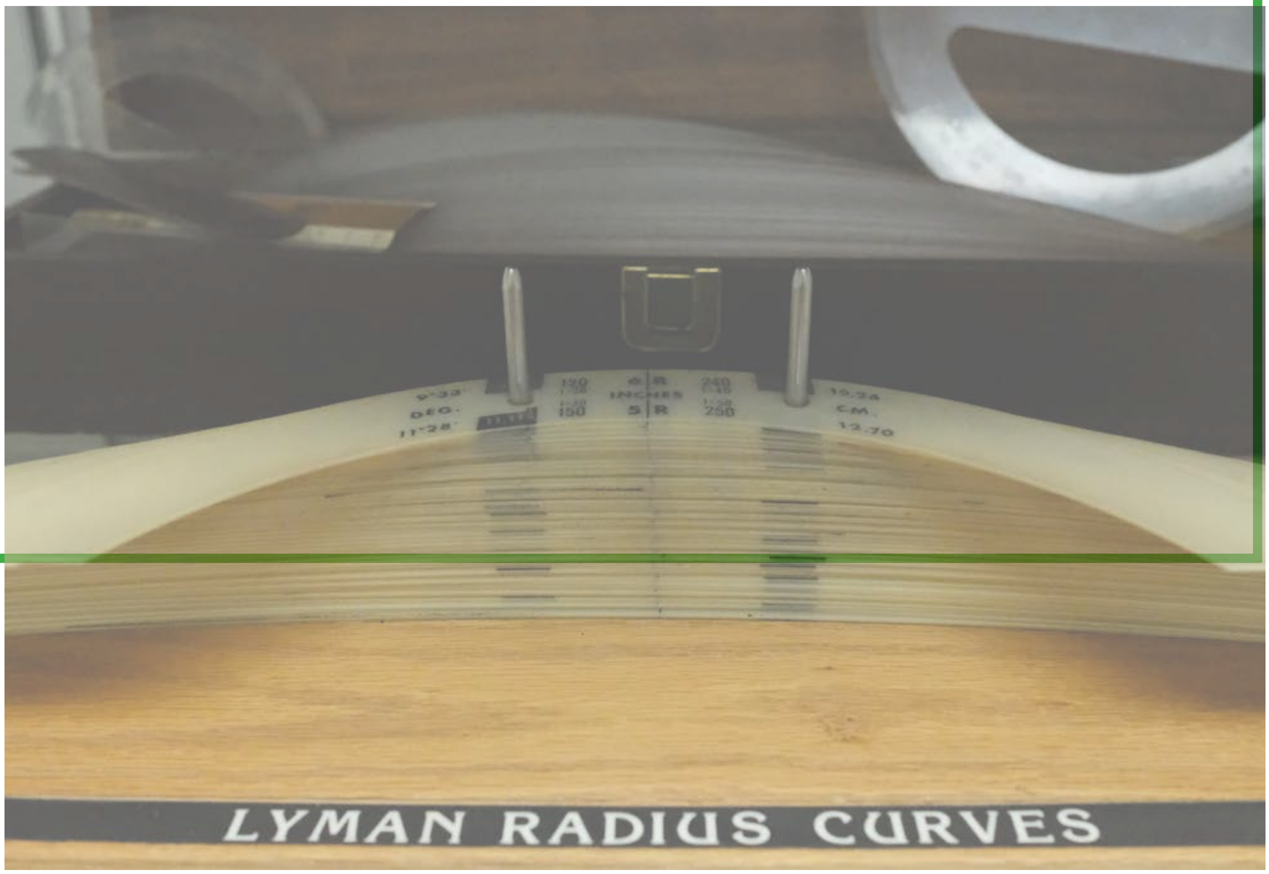
s Directory



A	
Accuright Surveys of Orlando, Inc.	407-894-6314
Agnoli, Barber & Brundage, Inc.	239-597-3111
AIM Engineering & Surveying	239-332-4569
Allen & Company, Inc.	407-654-5355
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Amerritt, Inc.	813-221-5200
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Avirom & Associates, Inc.	561-392-2594
Axis Geospatial SE, LLC.	386-439-4848
B	
Banks Engineering	239-939-5490
Barnes, Ferland and Associates, Inc.	407-896-8608
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Bartram Trail Surveying, Inc.	904-284-2224
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Betsy Lindsay, Inc.	772-286-5753
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Boatwright and Durden Land Surveyors, Inc.	904-241-8550
Bock & Clark Corporation	330-665-4821
Bowman Consulting Group, Ltd.	703-464-1000
Brown & Phillips, Inc.	561-615-3988
BSE Consultants, Inc.	321-725-3674
Buchanan & Harper, Inc.	850-763-7427
Bussen-Mayer Engineering Group, Inc.	321-453-0010

C	
C & M Road Builders, Inc.	941-758-1933
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Cardno, Inc.	407-629-7144
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Clements Surveying, Inc.	941-729-6690
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Control Point Associtės FL, LLC.	908-668-0099
Cousins Surveyors & Associates, Inc.	954-689-7766
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Cross Surveying, LLC.	941-748-8340
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Cumbey & Fair, Inc.	727-324-1070
D	
Dagostino & Wood, Inc.	239-352-6085
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Dewberry	321-354-9729
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Douglass, Leavy & Associates, Inc.	954-344-7994
DRMP, Inc.	407-896-0594
DSW Surveying & Mapping, PLC.	352-735-3796
Duncan Parnell	407-601-5816

E	
Echezabal & Associates, Inc.	813-933-2505
ECHO UES, Inc.	888-778-3246
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Eiland & Associates, Inc.	904-272-1000
Element Engineering Group, LLC.	813-386-2101
Engenuity Group, Inc.	561-655-1151
Engineering Design & Construction, Inc.	772-462-2455
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ER Brownell & Associates, Inc.	305-860-3866
ETM Suryeying & Mapping	904-642-8550
Exacta Land Surveyors, Inc.	305-668-6169
F	
First Choice Surveying, Inc.	407-951-3425
F.R. Aleman & Associates, Inc.	305-591-8777
F.R.S. & Associates, Inc.	561-478-7178
Florida Design Consultant, Inc.	727-849-7588
Florida Engineering & Surveying, LLC.	941-485-3100
FLT Geosystems	954-763-5300
Fortin, Leavy, Skiles, Inc.	305-653-4493

G	
Geodata Consultants, Inc.	407-732-6965
Geoline Surveying	386-418-0500
Geomatics Corporation	904-824-3086
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GeoPoint Surveying, Inc.	813-248-8888
George F. Young, Inc.	727-822-4317
GeoSurv, LLC.	877-407-3734
Germaine Surveying, Inc.	863-385-6856
GPI Geospatial, Inc.	407-851-7880
Gustin, Cothern & Tucker, Inc.	850-678-5141
H	
Hamilton Engineering & Surveying, Inc.	813-250-3535
H.L. Bennett & Associates, Inc.	863-675-8882
Hanson Professional Services, Inc.	217-788-2450
Hanson, Walter & Associates, Inc.	407-847-9433
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Hyatt Survey Services, Inc.	941-748-4693
I	
I.F. Rooks & Associates, LLC.	813-752-2113
J	
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John Mella & Associates, Inc.	813-232-9441
Johnston's Surveying, Inc.	407-847-2179

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KCI Technologies, Inc.	954-776-1616
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Lengemann	352-669-2111
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M	
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Massey-Richards Surveying & Mapping, LLC.	305-853-0066
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McLaughlin Engineering, Co.	954-763-7611
Metron Surveying and Mapping, LLC.	239-275-8575
Metzger + Willard, Inc.	813-977-6005
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Moore Bass Consulting, Inc.	850-222-5678
Murphy's Land Surveying	727-347-8740

N	
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NV5, Inc.	407-896-3317
O	
Omni Communications, LLC.	813-852-1888
On The Mark Surveying, LLC.	321-626-6376
P	
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Platinum Surveying & Mapping, LLC.	863-904-4699
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Porter Geographical Positioning & Surveying, Inc.	863-853-1496
Pulice Land Surveyors, Inc.	954-572-1777
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Q Grady Minor & Associates, PA	239-947-1144
R	
Richard P. Clarson & Associates, Inc.	904-396-2623
R.M. Barrineau & Associates, Inc.	352-622-3133
R.J. Rhodes Engineering, Inc.	941-924-1600
Reece & White Land Surveying, Inc.	305-872-1348
Robayna and Associates, Inc.	305-823-9316
Rogers, Gunter, Vaughn Insurance, Inc. (HUB FL)	850-386-1111

S	
Sergio Redondo & Associates, Inc.	305-378-4443
Settimio Consulting Services	850-341-0507
SGC Engineering, LLC.	207-347-8100
Shah Drotos & Associates, PA	954-943-9433
Shannon Surveying, Inc.	407-774-8372
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Sliger & Associates	386-761-5385
Southeastern Surveying & Mapping Corp.	407-292-8580
Stephen H. Gibbs Land Surveyors, Inc.	954-923-7666
Stoner & Associates, Inc.	954-585-0997
Strayer Surveying & Mapping, Inc.	941-497-1290
Suarez Surveying & Mapping, Inc.	305-596-1799
Surv-Kap	520-622-6011
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T	
T2UES, Inc.	855-222-8283
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Tuck Mapping Solutions, Inc.	276-523-4669

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Upham, Inc.	386-672-9515
W	
Wade Surveying, Inc.	352-753-6511
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WBQ Design & Engineering, Inc.	407-839-4300
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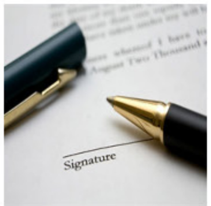
2020 eLearning Courses

Basics of Real Property Course #8360 (3 General CEC)

$ 70.00

Boundaries in Florida Course #8255 (6 SOP/L&R CEC)

$ 120.00



Contracts for the Professional Course #8412 (3 General CEC)

$ 70.00

Elevation Certificates and the Community Rating System Course #8256 (3 General CEC)

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Ethics for the Design Professional Course #8621 (6 General CEC)

$ 120.00

Florida Laws Course #7149 (6 SOP/L&R CEC)

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Professional Ethics and Professional Courtesy FULL Video Course #8363 (6 General CEC)

$ 120.00

Georgia Technical Standards for Property Surveys Course #8554 (6 General CEC)

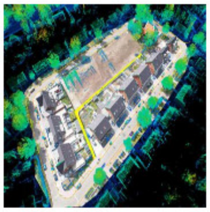
$ 120.00

History of Surveying Course #7140 (6 General CEC)

$ 120.00

Identification of Native and Non-Native Trees in Florida Course #8132 (6 General CEC)

$ 120.00



Introduction to Photogrammetry Course #7968 (3 General CEC)

$ 70.00

Land Tenure and Cadastral Systems Course #8260 (6 General CEC)

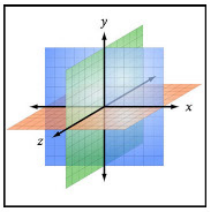
$ 120.00

Map Projections and Plane Coordinate Systems Course #8261 (6 General CEC)

$ 120.00

Mean High Water Observations & Computations Course #8262 (6 General CEC)

$ 120.00

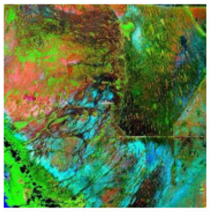


Practical Geometry for Surveyors Course #7141 (6 General CEC)

$ 120.00

Public Land Survey System Course #7147 (6 General CEC)

$ 120.00



Remote Sensing Applications to Surveying & Mapping Course #7148 (6 General CEC)

$ 120.00

Writing Boundary Descriptions Course #8362 (3 General CEC)

$ 70.00

Correspondence Courses

Step 1: Choose Course(s)

☐ **5J-17 Standards of Practice (SOP)**, #6962, 6 SOP/L&R CEC

☐ **A History of the Prime Meridian Marker**, #8403, 3 General CEC

☐ **Basics of Real Property**, #8359, 3 General CEC

☐ **Boundaries in Florida**, #7667, 6 SOP/L&R CEC

☐ **Chapter 177, Platting (Plat Law)**, #6970, 6 SOP/L&R CEC

☐ **Client Satisfaction Excellence for Surveying and Mapping Professionals**, #7229, 6 General CEC (*Only available by mail)*

☐ **Contracts for the Professional**, #8411, 3 General CEC

☐ **Critical Communication for Surveying & Mapping Professionals**, #7228, 6 General CEC (*Only available by mail)*

☐ **Digital Signatures for Surveyors**, #8491, 3 General CEC

☐ **Elevation Certificates and the Community Rating System**, #8257, 3 General CEC

☐ **Ethics for the Design Professional**, #8620, 6 General CEC

☐ **Florida Laws**, #6966, 6 SOP/L&R CEC

☐ **Georgia Technical Standards for Property Surveys,** #8553, 6 General CEC

☐ **Geographic Information Systems (GIS)**, #7107, 6 General CEC

☐ **History of Surveying**, #7108, 6 General CEC

☐ **Identification of Native and Non-Native Trees in Florida**, #7874, 6 General CEC

☐ **Introduction to Photogrammetry**, #7887, 3 General CEC

☐ **Land Tenure and Cadastral Systems**, #7829, 6 General CEC

☐ **Map Projections and Plane Coordinate Systems**, #7669, 6 General CEC

☐ **Mean High Water Observations and Computations**, #8220, 6 General CEC

☐ **Practical Geometry for Surveyors**, #7109, 6 General CEC

☐ **Public Land Survey System**, #6979, 6 General CEC

☐ **Remote Sensing Applications to Surveying & Mapping**, #6972, 6 General CEC

☐ **Stress Management for Surveyors & Mappers: How to be Productive Under Pressure**, #6902, 6 General CEC (*Only available by mail)*

☐ **Time Management for Surveyors & Mappers: How to be Productive & Exercise Time Mastery in A Hectic World**, #6901, 6 General CEC (*Only available by mail)*

☐ **Writing Boundary Descriptions**, #8361, 3 General CEC

Step 2: Choose Member Type

☐ **FSMS Member**

EMAILED	Fee		Quantity			Amount
6 CEC	$115 Per Course	x	______	=	$	______________
3 CEC	$58 Per Course	x	______	=	$	______________
MAILED						
6 CEC	$125 Per Course	x	______	=	$	______________
3 CEC	$68 Per Course	x	______	=	$	______________
	TOTAL		______		$	______________

☐ **Non-Member**

EMAILED	Fee		Quantity			Amount
6 CEC	$135 Per Course	x	______	=	$	______________
3 CEC	$78 Per Course	x	______	=	$	______________
MAILED						
6 CEC	$145 Per Course	x	______	=	$	______________
3 CEC	$88 Per Course	x	______	=	$	______________
	TOTAL		______		$	______________

☐ **Non-Licensed in ANY State**

EMAILED	Fee		Quantity			Amount
6 CEC	$100 Per Course	x	______	=	$	______________
3 CEC	$60 Per Course	x	______	=	$	______________
MAILED						
6 CEC	$110 Per Course	x	______	=	$	______________
3 CEC	$70 Per Course	x	______	=	$	______________
	TOTAL		______		$	______________

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Name: ________________________________ PSM#: ________ State: _____ FSMS Member: ___ YES ___ NO

Firm: ____ Sustaining Firm: ___ YES ___ NO

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City/State: ____ Zip Code: ____________

Email Address: ____________________________________ Work Phone: ____________________

Payment Information: ________ Check Enclosed (Payable to FSMS) ________ VISA/MasterCard/American Express

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Chipola
Jesse Snelgrove
jsnelgrove@
snelgrovesurveying.com

Northwest FL
Jeremy Fletcher
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Kathy Wade
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N. Central FL
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Scott Edenfield
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Leon Hampton
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Anthony Sanzone
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bellsouth.net

District 4

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Larry Sharp
lsharp@collinssurvey.com

Tampa Bay
Charlie Arnett
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southeasternsurveying.com

District 5

Charlotte Harbor
Derek Miller
millersurveying@
comcast.net

Collier-Lee
Steve Shawles II
sshawles@cesincusa.com

Manasota
Donald A. Bouchard, Jr.
donb@znseng.com

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Earl Soeder
earl@gpserv.com

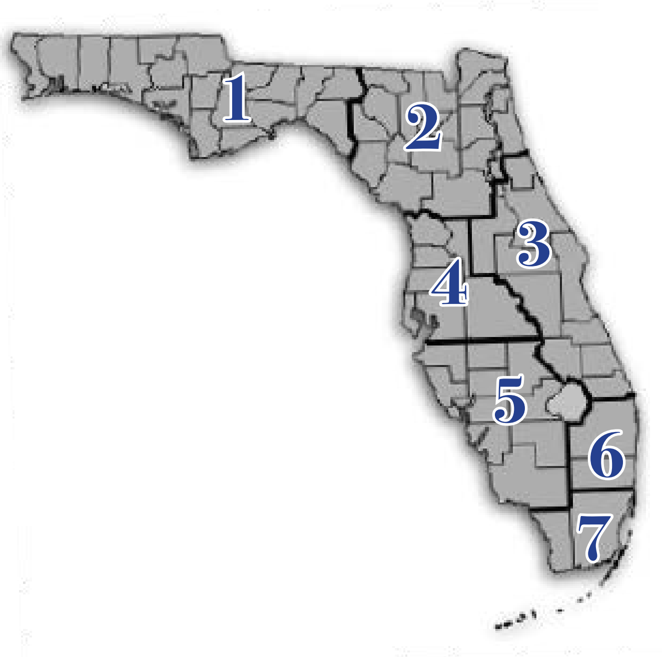
Palm Beach
Clyde Mason
clyde@ritzel-mason.com

FAU Geomatics
Gerardo Rojas
grojas2017@fau.edu

District 7

Miami-Dade
Frank Pauas-Suiero
fparuas@gpinet.com

2020 Districts & Directors



District 1 -/Northwest

Bay, Calhoun, Escambia, Franklin, Gadsden, Madison, Okaloosa, Santa Rosa, Taylor, Wakulla, Walton, Washington

Eric Stuart
(850)857-7725
eric.stuart@sam.biz

Chad Thurner
(850) 200-2441
chad.thurner@sam.biz

District 2 / Northeast

Alachua, Baker, Bradford, Clay, Columbia, Dixie, Duval, Gilchrist, Hamilton, Lafayette, Levy, Marion, Nassau, Putnam, Suwannee, St. Johns, Union

Nick Digruttolo
(863) 344-2330
ndigruttolo@pickettusa.com

Randy Tompkins
(904) 755-4235
randytompkins1@
outlook.com

District 3/East Central

Brevard, Flagler, Indian River, Lake, Okeechobee, Orange, Osceola, Seminole, Martin, St. Lucie, Volusia

Al Quickel
(407) 567-1566
alq.fsms@gmail.com

Howard Ehmke
(561) 682-2987
hehmke@sfwmd.gov

District 4/ West Central

Citrus, Hernando, Hillsborough, Pasco, Pinellas, Polk, Sumter

Greg Prather
(863) 533-9095
gprather@pickettusa.com

~~Justin Ferrans~~
~~(727) 461-6113~~
~~justin@polaris-survey.com~~

District 5/ Southwest

Collier, Charlotte, DeSoto, Glades, Hardee, Hendry, Highlands, Lee, Manatee, Sarasota

Shane Christy
(941) 748-4693
shane@hyattsurvey.com

Jeffrey Cooner
(239) 829-7016
jeff.cooner@cardno.com

District 6/Southeast

Broward, Palm Beach

Ken Buchanan
(561) 687-2220
ken.buchanan@wginc.com

Dodie Keith-Lazowick
(954) 788-3400
dkeith@keithteam.com

District 7/South

Miami-Dade, Monroe

Manny Vera, Jr.
(305) 221-6210
mverajr@mgvera.com

Lou Campanile
(954) 980-8888
lou@campanile.net

NSPS Director

Russell Hyatt
(941) 748-4693
russell@hyattsurvey.com

Additional Information

Past Presidents

1956
H.O. Peters
Harry C. Schwebke
John P. Goggin
R.H. Jones

1960
Hugh A. Binyon
Russell H. DeGrove
Perry C. McGriff
Carl E. Johnson
James A. Thigpenn, III
Harold A. Schuler, Jr.
Shields E. Clark
Maurice E. Berry II
William C.. Hart
Frank R. Schilling, Jr.

1970
William V. Keith
James M. King
Broward P. Davis
E.R. (Ed) Brownell
E.W. (Gene) Stoner
Lewis H. Kent
Robert S. Harris
Paul T. O'Hargan
William G. Wallace, Jr.
Robert W. Wigglesworth

1980
Ben P. Blackburn
William B. Thompson, II
John R. Gargis
Robert A. Bannerman
H. Bruce Durden
Buell H. Harper
Jan L. Skipper
Steven M. Woods
Stephen G. Vrabel
W. Lamar Evers

1990
Joseph S. Boggs
Robert L. Graham
Nicholas D. Miller
Loren E. Mercer
Kent Green
Robert D. Cross
Thomas L. Conner
Gordon R. Niles, Jr.
Dennis E. Blankenship
W. Lanier Mathews, II
Jack Breed

2000
Arthur A. Mastronicola
Michael H. Maxwell
John M. Clyatt
David W. Schryver
Stephen M. Gordon
Richard G. Powell
Michael J. Whitling
Robert W. Jackson, Jr.
Pablo Ferrari
Steve Stinson

2010
Dan Ferrans
Jeremiah Slaymaker
Ken Glass
Russell Hyatt
Bill Rowe
Dale Bradshaw
Lou Campanile, Jr.
Bob Strayer, Jr.
Dianne Collins

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