

# SURVEYOR

*California*

Fall 2007 Issue #152



## MEET THE LAND SURVEYING COLLEGES & UNIVERSITIES

*Starting on page 10*



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# SURVEYOR *California*

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“Recognizing that the true merit of a profession is determined by the value of its services to society, the California Land Surveyors Association does hereby dedicate itself to the promotion and protection of the profession of land surveying as a social and economic influence vital to the welfare of society, community, and state.”

“The purpose of this organization is to promote the common good and welfare of its members in their activities in the profession of land surveying, to promote and maintain the highest possible standards of professional ethics and practices, to promote professional uniformity, to promote public faith and dependence in Land Surveyors and their work.”

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## On The Cover:

### Meet the Land Surveying Colleges & Universities



## From the Editor

There was a time when higher education was represented by a high school diploma. At least that's what my father used to tell me. Like most Polish immigrants at that time, my grandparents arrived in the States with little wealth. They were grateful to live simply and farm the shallow, rocky soil of northwestern Connecticut. But they hoped for a better life for their children, and they knew that education was the way. My father's graduation from high school was a rare achievement for a farm kid, circa 1934. Throughout the course of his life he leveraged that education to good advantage, and he never tired of thanking his parents for their vision.

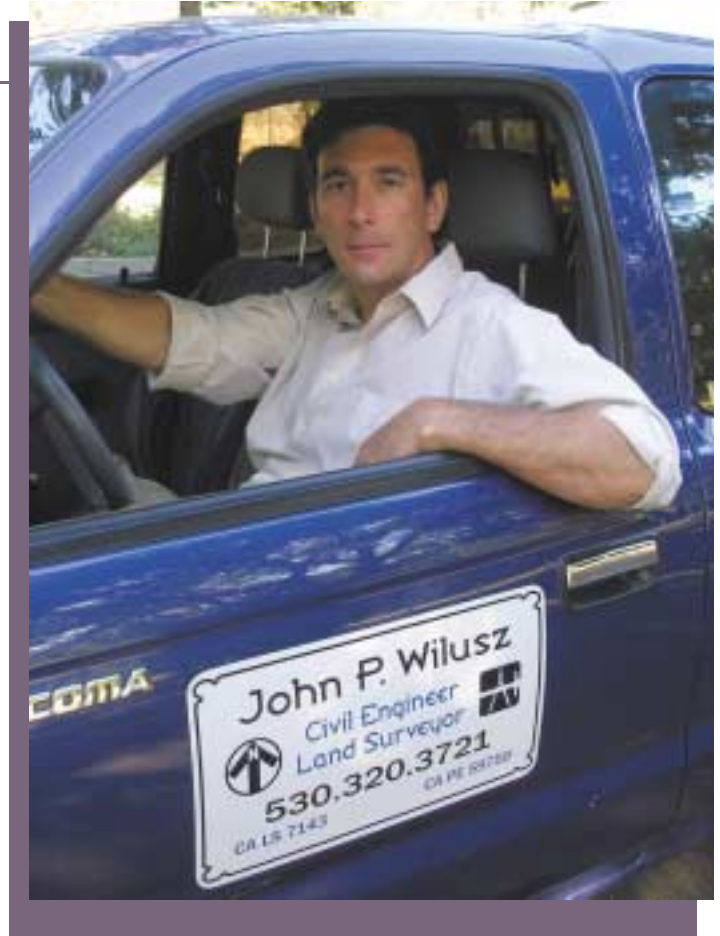


John P. Wilusz, Sr., circa 1975

I suppose that's why he was so adamant about sending his own children to college. When I was in 8th grade he handed me a sheet of paper from his yellow legal pad. The page was filled; he had written down all the professional careers he could think of. Pop decided it was time for me to announce what I planned to study in college. He wanted to know what I intended to do for a living. Seeing how I wasn't even in high school yet, I hadn't put much thought into the matter. Four years seemed like an awfully long way down the road. Surely there would be ample time to figure that out later. However, I knew that to say such things would only provoke my father. A more obedient son would have kept his mouth shut.

When Pop's barrage ended, I picked *civil engineer* from his list and hoped for the best. Shortly thereafter, he dropped me off at the office of a local engineer so I could learn something about my new career. I learned later that Mr. Babbitt, PE, and my father had never met before. And yet such a grand reception I received! Mr. Babbitt explained to me, in words I could understand, what *civil engineers* are all about. He gave me a tour of his office and introduced me to his staff. He showed me pictures of his projects. I had no idea why, but Mr. Babbitt seemed thoroughly delighted to do this for me. It was fun and I liked him. More to the point, after that day I knew I would be going to college after all, however circuitous my own path would ultimately be.

This issue of the *California Surveyor* focuses education. Have you ever wondered what surveying students are learning in college these days? What kinds of courses are available to them? What degrees and certificates are available from California's schools? Have you wondered who is supporting these programs? Are enrollments increasing or declining? Have you wondered if there are opportunities for you to teach a surveying class? Many



surveyors question why the term *Geomatics* is used at some colleges and universities. Are you one of them? There is much talk these days about the future of our profession. Do you know what's being done about such concerns? And who's doing it? Can professional societies, industry, and private surveyors help? Can you help? If so, how? Read on and you'll find the answers to these questions and more. You'll also see that even though programs and curriculums vary across the state, there is one thing they all have in common. All share the goal of providing our profession with a competent, educated workforce for the future.

Several years ago the mother of a local high school student called my office. Her daughter's math teacher directed his students to interview, and report on, a person that uses math in the workplace. The girl's mom asked if I would be willing to help. Oh, yes! It's not often that we in technical careers have the opportunity to talk to young people about our work. Through that experience, I finally understood why Mr. Babbitt was so happy to speak with me, those many years ago. If you haven't yet had a similar experience you don't know what you're missing. Opportunities for this kind of service are abundant, and you can read about many of them in the following pages. Give it try; you'll be glad you did. ❖

John P. Wilusz, PLS, PE, is in private practice in Citrus Heights, CA



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By: Steve C. Shambeck, PLS - President

# President's Message

## Boy Scouts and Girl Scouts – another Opportunity to Spread the Word

When I was a young boy growing up in the 1960's, every kid I knew wanted to be a fireman, a race car driver or an astronaut. Our dreams were influenced not only by the images we saw on the screen of our black and white televisions, but by what we read and what we learned from our teachers, preachers, parents and grandparents. Not much has changed really except that much of what influences our youths comes less from reading, parents and teachers and more from television and the media.



CLSA's recent recruitment efforts have been a refreshing return to the old school technique of standing up in front of the kids and giving a good old fashioned "show and tell" demonstration. It has been exciting to see the responses from the local schools, the volunteerism of the CLSA members and the reaction from the students and their parents. But much of our efforts have been directed at the soon-to-graduate high school kids. I believe CLSA must also reach out to younger kids and to the adult community in a campaign of education and awareness.



We have a great opportunity to reach out to younger people by being more active with the scouting community.

CLSA has a Scouting Merit Badge Committee chaired by Travis Kottwitz out of the San Diego Chapter. Notice that the committee name does not limit us to "boy" scouts. Travis and Dee Smith, also out of the San Diego Chapter, have both been involved in a presentation to girl scouts in the area as well. Every community throughout the State has boy scout and girl scout troops that are, most likely, starving



for speakers and presenters to come in and teach the youngsters about interesting and exciting professions. At the very least, it should be very simple to contact the local scouting troop and set up an opportunity to make a short presentation at one of their meetings.

Another opportunity would be to participate in a scouting merit badge program. Travis and I would like to see every Chapter in the State have a merit badge coordinator who can help motivate members of the local Chapter to get involved. CLSA can supply your Chapter with a

power point program that you can edit or use as is to help guide you through the program. It's not that difficult and the entire program can be done in one day if you have enough volunteers to help. Travis and I are also happy to take e-mails or phone calls from anyone who would like to learn more about how they can get more involved in the program. I had the pleasure of assisting in a Boy Scout Merit Badge program a while back and I found it to be very rewarding. The young men I got to work with were very inquisitive and challenged by the program. They really liked learning how to operate the robotic totalstation and spearing a plumb bob through the fallen leaves. By the end of the day, it was obvious to me that a few of them found surveying to be a very interesting option for their future.



Boy Scouts, Girl Scouts, Cub Scouts, Webelows, Indian Guides and other youth groups provide us with an excellent opportunity to reach out to a younger generation. Please take this into serious consideration as you ponder what you can do to help influence the youth of America in a positive way. Let's not let MTV beat us in influencing the youth of this Country on their career options. ❖

Sincerely,  
Steve Shambeck  
CLSA State President





# EFFICIENCY BEYOND MEASURE



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# MEET THE LAND SURVEYING COLLEGES & UNIVERSITIES



## **Why Geomatics? Sticks and Stones May Break My Bones, But the “G” Word Will Never Hurt Me**

*By: James K. Crossfield, PhD., PLS*

The Bachelor of Science degree in Surveying and Photogrammetry Technology originated at Fresno State College in 1971 (based on the 1970-1971 catalog). Program founder Ed Kulhan managed to create this program almost single handedly. He disliked the word “Technology” because he knew that the discipline was much more professional than that, but had to go along with the “T” word to get the Dean to agree to support the program. Throughout the following year, Ed waited for an opportunity to correct the problem. One day the Dean was out of town, but his office door was open and the draft 1971-1972 catalog was on his desk. Using a straight edge and a pen, Ed carefully lined out the word

“Technology”, and quietly made his way back to his own office. A few days later the Dean returned, approved the document, and sent it forward. The “T” word was gone.

### **Enrollment Grows**

Program enrollment continued to grow throughout the 1970’s. There were 33 graduates (probably still a national record for four-year surveying programs) in the year 1983 alone. Ed was gone by then but before he left (1979), he did everything possible to get the program nationally accredited. The accreditation team arrived during the fall of Ed’s final year with the program. Thanks to the then-recent arrivals of Dr. Nader (1975) and Dr.

*Continued on next page*



Hussain (1978), the accreditation visit was successful and the nation's first four-year surveying program was ABET accredited. Note that since the program was not a technology degree, technology accreditation was not considered appropriate. The only other form of accreditation at that time was "Engineering" accreditation. Accreditation was reaffirmed in 1982, but the visiting team made one important recommendation, namely that the degree name had to include the "E" word (engineering). The catalog was corrected just in time (1985-1986) for the subsequent ABET visit in the fall of 1985. This visit was also successful. The new title was Surveying Engineering. However, the emphasis was still on surveying, as the "E" word was only added to insure that the program provided graduates with an accredited, professional-level degree.

### **Commitment to Land Surveying Reaffirmed**

Although graduates received excellent job and career opportunities, the number of persons willing to move to Fresno (while getting a four-year surveying degree) began to slowly decline. The demand for graduates has always been high, but professionals in other parts of the state

(especially the Los Angeles Basin and the Bay Area) found it increasingly difficult to find sufficient graduates willing to move to their regions. There was also some concern among some that the program was actually a "Photogrammetry" program, disguised as a surveying program. A meeting at Fresno State was held in the summer of 1985 to try to reach a satisfactory resolution. Newly proposed coursework in the boundary surveying area was summarized, and the commitment of the program to serve all surveying-based professionals in the state was reaffirmed.

### **Boundary-Related Coursework**

Since that time, as promised, our boundary surveying content has grown nicely. The 1985 catalog indicated required coursework in the following (semester units are provided in parenthesis): Boundary Control and Legal Principles (3), Land Survey Systems (3), and Subdivision Design (2). Required boundary-related classes then (and still today) included: Land Surveying [USPLSS] (3), Boundary Control and Legal Principles (3), Boundary Survey Design (3), Subdivision Design (3) and Real Property Descriptions (3). Meanwhile, photogrammetry-specific con-

*Continued on next page*



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Descriptions (3). Meanwhile, photogrammetry-specific content has been reduced from about twelve semester units to six. Among all four-year surveying programs in the country, this is the largest concentration of required land surveying coursework. Let there be no doubt, this is a Land Surveying curriculum, as well as a curriculum that recession-proofs graduates by giving them detailed coursework in Geodesy, Digital Mapping, Photogrammetry and GIS.

### The “G” Word Shapes Student Perceptions

The number one priority at any college or university is usually enrollment. Big enrollment means more funding, which equates into better labs, more professors and ultimately, more graduates. Laval University in Quebec turned their surveying program around in the late 1980’s by changing the program name to Geomatics. Their enrollment rocketed up to 300 (easily largest in the world at that time). Interestingly, many of their new students were women. About 1990, the University of Maine conducted a study and found that the word “Geomatics” was significantly more preferred by high school graduates more than the word “Surveying”. Then-senior Roger Watkins agreed to conduct an FSU survey to determine the preferences of high school mathematics students in California. His 1992 findings were somewhat shocking. Five different Surveying and Geomatics synonyms were compared to four other disciplines: Civil Engineering, Mechanical Engineering, Electrical Engineering and Computer Science. When the “G” word was used (Geomatics or Geomatics Engineering), students rated the discipline second or third, but when the “S” word was used, (Surveying, Surveying and Mapping or Surveying Engineering), prospective students rated the discipline fourth of fifth.

### Continuing Challenges To Attract Students

Later revelations determined that Laval separated their students into two options: Surveying (30 students with a surveying focus) and Geomatics (270 students with a GIS focus). Their graduates could not pass the licensing exams (no wonder). That program then saw a rapid enrollment decline. The University of Maine program changed its name from Surveying Engineering to Geo-spatial Information Science and Engineering (dropping the “S” word but not adopting the “G” word). Since hardly anyone could figure out what that meant, over time their undergraduate program enrollment dropped to the point where the depart-

ment imploded. Fresno State Surveying Engineering program enrollment went from an all time high of 160 in 1992 to approximately 50 in 1996. Something needed to be done. But the errors made by Laval and Maine needed to be avoided. The plan was to keep the name simple (particularly if it appealed to the target audience) while keeping all of the land surveying content.

### Geomatics Program Named

The Program Advisory Council at Fresno State is comprised of 8-10 surveying and mapping professionals. When the Council met on May 10, 1996, members present included: Ken Meme, Axel Hoffman, Alan Mikuni, Earl Cross, Larry Fenske, Hans Haselbach, Dennis Meyer and Paul Enneking. After a freewheeling, one-hour discussion, and taking into account the history cited above, the Council voted unanimously to change the program name to Geomatics Engineering (note that faculty do not vote here). However, only the name, and not the curriculum, changed. The strong surveying content remained.

### The New Name Works

The rationale was simply that if prospective program students did not like the term “Surveying” we would use a term that was acceptable to them. We would get them trained for a professional surveying and mapping career regardless of the name. This new plan worked well, as enrollment increased to 80 by 2005. We are pleased that this increase has generated more graduates to work in surveying-related professional careers. However, as technology increasingly reduces crew size, there are fewer and fewer sub-professionals on crews who might attend college in order to get ahead. Thus, it appears increasingly necessary to recruit directly out of high school.

### Idea For Further Increasing Enrollment

As it has in the past, the program at Fresno State continues to work towards increasing enrollment. You, as a licensed professional and member of CLSA, can help too. Following are some ideas to further our mutual goal of increasing the pool of educated professionals:

1. Make every effort to send prospective students to college for their surveying education. That includes spouses, partners, children, relatives, co-workers and employees. If you go recruiting to high schools or junior colleges, then spread the word, generate excitement and urge them to attend college to further their aims.
2. Don’t waste time arguing about the name; use whatever works for your target audience. If prospective recruits ask “*Is that really surveying you are talking*”

Continued on page 14



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about?”, and it looks like more than a few are outdoors-types, then say “Yes, this is surveying”. If the crowd consists mostly of computer-types then use the “G” word and impress them with talk about working with NASA, photogrammetry, remote sensing and GIS. The boundary surveying possibilities will come later as they progress through the curriculum.

**3.** Send the names and addresses of every Trig Star contestant in the state to both two-year and four-year colleges so they can try to recruit them by mailing an information packet.

**4.** Offer summer internships (even providing housing when necessary) to support the students once they get enrolled.

**5.** Offer scholarship support to help these students while they are still in college. Organizations should strongly consider the forgivable loan. For example, the student applicant can agree to work for the Sponsor after graduation for a set number of years. Dropouts, and those who go to work for different organizations, pay back the loan in full.

### What’s happening now?

Fresno State is beginning a major recruitment effort this year. As part of this effort we plan to collect data regarding the goals of incoming students. We intend to find out what external input made them choose this program of study. If enrollment grows by at least 60% (enrollment goes from 60

to 100) and it appears that “Surveying” is the primary reason (60% of new students say they came to study Surveying rather than Geomatics), the faculty, in consultation with students and our Advisory Council, will seriously reconsider the name for this program. New students will be asked to provide the following information beginning in August, 2007:

Between the following two choices, check the one that best describes what you are here to study:

\_\_\_\_\_ **Land Surveying**                      \_\_\_\_\_ **Geomatics**

Over the next several years we will assess the value of these initiatives and respond accordingly.

### Kudos For CLSA

I know that I speak for all the faculty and students here when I say thanks to CLSA for its generous support over the years. We are particularly grateful for the efforts of Jim Adams, an early CLSA president, for his instrumental support during the program’s early days. Today, CLSA continues to provide an excellent array of scholarships and recruitment efforts to help the program. Getting the students here is and always will be the biggest challenge. Working together, we can continue to generate an educated workforce for the future of the surveying profession.

*James K. Crossfield, PhD, PLS, is the Chair of the Department of Civil and Geomatics Engineering and Construction at California State University, Fresno ✦*

## College of the Canyons From Ancient Rome to the Final Frontier

By: Regina Blasberg, Engineering Department Faculty, College of the Canyons



**T**he ancient Romans, Thomas Jefferson and Henry David Thoreau mastered it. Walt Disney and Daniel Boone learned its principles. Without it, the national project to search for extraterrestrial intelligence (SETI) wouldn’t be able to expand and reach out to the stars. What do these unlikely bedfellows have in common? We’ll give you a hint. If something needs to be straight, level, precisely measured and placed, the skills of this profession need to be mastered.

Of course by now you guessed it. We’re talking about land surveying and land surveyors. In September of 2006, College of the Canyons (COC) in Valencia successfully launched its new Land Surveying Associate of Science degree program. At COC, students can now obtain either an Associate in Science or a Certificate of Achievement. The program is fully funded with enough resources to purchase (5) Topcon GTS-230W total stations, tripods, rods, prisms, plumb bobs, data collectors and much more.

*Continued on page 16*



# Choice is good.



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The courses required by the program are as follows:

SURV 101 – Introduction to Land Surveying (4.0 units)	SURV 102 – Advanced Land Surveying (4.0 units)
SURV 103 – Advanced Applications in Surveying I (3.0 units)	SURV 104 – Advanced Applications in Surveying II (3.0 units)
SURV 105 – Boundary Control and Legal Principles I (3.0 units)	SURV 106 – Boundary Control and Legal Principles II (3.0 units)
SURV 107 – Construction Surveying (4.0 units)	SURV 110 – Computer Aided Drafting for Surveyors (3.0 units)
GEOG 151 – Intro to Geographic Information Systems (4.0 units)	MATH 102 – Trigonometry (3.0 units)

### Purpose of the Land Surveying Program

The purpose of the Land Surveying program at College of the Canyons is to provide the student with a thorough background in land surveying and mapping, in addition to an introduction to the collecting, manipulating, formatting and mapping of geospatial data. Upon completion of the program, students will have the technical expertise necessary for an entry level position in the field of land surveying, or related fields of geographic information systems specialists, architectural services, and engineering services.

The depth and breadth of this profession is largely misunderstood by the public, even though it has its roots in ancient cultures and is a necessary element of growth and development throughout the world. The Romans and other ancient civilizations perfected mathematics and geometry to a high level and built roads, aqueducts and buildings that have lasted millennia. Thomas Jefferson, a creative force during the birth of our country, used his skills to lay out the impressive plantation home and gardens he called Monticello, while Daniel Boone used rudimentary land surveying principles to chart America’s way into the west. Thoreau, the noted writer, was also an avid environmentalist and perfected his skills while on treks through the wilds of Massachusetts, New Hampshire and Maine. Disney, a renaissance man of a different sort, brought his vision of an entertainment center in southern California to fruition, much through his own design and understanding of the principles of land surveying.

But what about the search for extraterrestrial intelligence? Since the beginning of the SETI project in the 1960s, scientists have had to compete for radio telescope time with other researchers. That will change in the near future when a new 350-antenna array is installed in northern California. But there’s a catch. The 350 antennas have to be precisely placed for optimal operation. So the whole project relies on - you guessed it - the land surveyors! The need for exact GPS observations,

specific measurements of the earth’s crust, precise locations of buried optical fiber and power cables and a million other details are dependent on how well the land surveyors do their work. While there is no guarantee that graduates of the COC Land Surveying program will play a pivotal role in establishing contact with extraterrestrial life, they are certain to position themselves for excellent career opportunities here on earth.

### For More Information About Classes

A more detailed class listing including times and general descriptions is available on our website, [www.canyons.edu](http://www.canyons.edu) by selecting, classes, then schedule of classes from the menu. For more information about taking a class in the COC Land Surveying program, please contact Ms. Blasberg via email, [regina.blasberg@canyons.edu](mailto:regina.blasberg@canyons.edu) or phone 661-362-5096. Also, please feel free to have any students with questions about the program or our classes contact Ms. Blasberg directly as well.

### If You Would Like To Teach

Currently, classes in the program are being taught by one full-time engineering faculty and one adjunct instructor. More part-time instructors are needed to keep up with the growth of the Land Surveying program. If you are interested in teaching any of the Surveying classes at the College, or if you have a particular area of expertise and would like to be a guest speaker, we are always looking for surveyors to share their experiences and insights with the students. We are accepting applications on an on-going basis. Minimum qualifications for teaching at the college are an Associate degree in any discipline and 6 years of surveying experience. If you need more information, please see our website or contact Ms. Blasberg via the contact information provided above. Application and job related information is also available on the web at: [http://jobs.canyons.edu/ASEWebAcademic/ASEPage\\_JobListMenu.asp](http://jobs.canyons.edu/ASEWebAcademic/ASEPage_JobListMenu.asp). ➦



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# The Surveying Program at Evergreen Valley College Teaching What the Industry Needs

By: John Yu and Alka Joshi

Evergreen Valley College (EVC), nestled in the southeast foothills of San Jose, offers the only complete Land Surveying program in the southern San Francisco Bay Area. The Surveying Certificate is based on an industry survey, input from an industry advisory committee and reviews of land surveyor licensing requirements, as well as National Society of Professional Surveyors (NSPS) and American Congress On Surveying and Mapping (ACSM) certification requirements. Designed to provide the formal theoretical and laboratory course work necessary to prepare students to pass both the Land Surveyor-In-Training Examination and the California Professional Land Surveyors Examination, the EVC Surveying Certificate also provides the nucleus of coursework for those planning to transfer to the Geomatics Engineering program at California State University, Fresno (CSUF), as well as other four-year surveying programs.

## Surveying Certificate Courses Include:

- Applied Math for Land Surveying
- Introduction to Surveying
- Plane Surveying
- Geographical Information System for Civil and Surveying
- Engineering Design and Graphics
- CAD for Civil Engineering, Surveying and Land Development
- Global Positioning System for Land Surveying
- Boundary Control and Legal Principles
- California Coordinate System
- Introduction to Photogrammetry
- Astronomy for Surveyors
- Map, Subdivision Map Act and Land Surveyors Act

## Students Taught Using Current Technology

Students in the EVC Land Surveying program are taught the latest technologies in GPS, GIS and Computer-Aided Design (CAD). With support from the National Science Foundation (NSF), Trimble, Autodesk, ESRI and Bentley, the EVC Land Surveying program acquired the latest hardware and software in GPS, GIS and CAD for

land surveying. A permanent GPS base station was established on the EVC campus for RTK surveying. EVC, with the support of NSF, Trimble, CSUF, and Santa Rosa Junior College, is in the process of developing a course on 3D-laser scanning and acquiring the necessary hardware and software for such a course. It is anticipated that the course will be offered in fall of 2008 or spring of 2009.

## Strong Academic and Administrative Support

The success of the EVC Land Surveying program is due in large part to the strong academic and administrative support, both from the local land surveying community and from the college. Courses are taught by Professional Land Surveyors, and other experts in the field. Prominent local surveyors serve on the program's industry advisory committee. Private firms and public agencies provide internship and practical work opportunities for EVC's land surveying students.

EVC President David Wain Coon, who led college support for the program, says, "We believe in embracing the unique strengths of our students. The Surveying Certificate is one way we do that by acknowledging students who simultaneously love working outdoors, enjoy working with computers and want a solid career." Following his lead, faculty and staff not only provide quality instruction, they advise students on career planning, job opportunities and the path to becoming a Professional Land Surveyor.

## Leading The Way

Nationally, Evergreen Valley College is also leading the way in incorporating advanced technologies into a two-year Land Surveying curriculum. In 2003, the college was one of the first in the land surveying field to receive a grant from the NSF, Advanced Technologies Education. As part of the grant, more than 500 pages of teaching materials in GPS, GIS and CAD for surveying were developed and many schools around the country are now using some of the materials. Earlier this year, EVC received another NSF grant

*Continued on next page*





Top: Evergreen Valley College surveying students perform GPS surveying in the field.

Right: Evergreen Valley College surveying students in the computer lab.

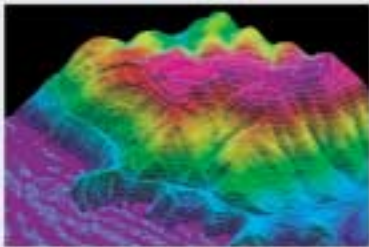
to develop curriculum on 3D-laser scanning for land surveying. At EVC, innovation never stops and our students always learn the latest technologies in the field. For more information go to: [www.evc.edu](http://www.evc.edu). ✚



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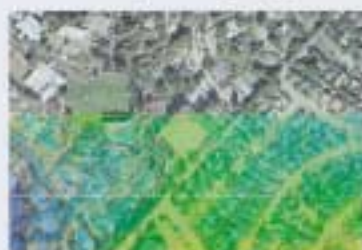
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# Oregon Institute of Technology

## Partnering with California for Educational Excellence

By: Michael D. Pulley, PLS

The main campus of Oregon Institute of Technology (OIT) is located in Klamath Falls, at the eastern edge of the Cascade Mountains in southern Oregon. This area has deep historical ties to northern California. Through the sharing of resources, such as the Klamath River, ties between the two states remain strong.

California students enjoy some attractive options for attending OIT. The Western Undergraduate Exchange (WUE) program offers students from the western states the ability to attend OIT at 1.5 times resident tuition. Furthermore, students who transfer to OIT with 30 credit hours or more from College of the Redwoods (Eureka), College of the Siskiyous (Weed) or Shasta College (Redding) are able to attend OIT at resident tuition rates. The Professional Land Surveyors of Oregon (PLSO) and the Land Surveyors Association of Washington (LSAW) are currently working towards the goal of allowing Washington students to attend OIT at resident (in-state) tuition.

### Multiple Degree Options

The OIT Geomatics department was separated from the Civil Engineering department in 2005. This decision, seen as risky by some, has provided positive results. The Geomatics program has thrived. OIT students can now choose between two degree options: a Bachelor of Science in Geomatics, Surveying Option and a Bachelor of Science in Geomatics, Geographic Information Systems (GIS) Option. Student response has been enthusiastic, with many students pursuing both options in an effort to increase their skills and employability.

But OIT's commitment to its students does not end in the classroom. The Geomatics department makes every effort to ensure that students who want a summer job in the industry will find one. The program also helps students find affordable housing.

### Program Offers Diverse Training

The Senior Practicum course illustrates the depth and breadth of Geomatics education available at OIT. Seven major projects are underway that give the students a chance to learn field surveying skills.

- In cooperation with the United States Forest Service, students are replacing a township corner, marking and posting true line, setting proportioned corners, and scribing bearing trees.
- Curt Smith, National Geodetic Survey (NGS) Advisor for Idaho and Montana, assisted in a project to establish an NGS HARN first-order vertical station a mile from campus.



*Student with Topcon GPS*

- At a local chipboard manufacturer, The Collins Company, students are using Leica scanners to measure wood chip piles for volume after having established GPS control around the site.
- An OIT GeoCache site was established in conjunction with the Teaching with Spatial Technology (TwIST) program. This allows instructors to teach using GPS systems, which are provided by the program.
- The Bureau of Land Management (BLM) requested a boundary determination that required the resurvey of two miles of line and the search and establishment of two Public Lands Survey System corners, with line to be marked and posted.

*Continued on next page*



Scribe Bearing Tree



- Roads within Crater Lake National Monument are being surveyed to determine precise centerline positions to be used to guide snowplows in the winter. This is to ensure that clearing efforts will occur on roads and damage to adjacent habitat is minimized.
- In cooperation with the National Guard, students are building a GIS for Kingsley Field. Current emphasis is on building a data dictionary, researching aerial photography, determining the best control methods, and document current data for future use.

### Industry Support

The OIT Geomatics department enjoys robust support from industry, and as a result has modern total stations and GPS equipment. PPI donated rebuilt total station batteries, and SECO donated instrument cases and has agreed to donate surveying vests beginning next year. Thanks to the efforts of faculty member Tim Kent, Topcon and Traverse PC recently created \$1500 scholarships for the program.

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### The Industry Advisory Committee

During a recent recruiting trip to OIT, I attended the second meeting of the Industrial Advisory Committee (IAC). The IAC is a collection of land surveying professionals from both public and private industry from California, Oregon and Washington, and was organized to review and advise the Geomatics department on its curriculum and recruiting efforts. Prior to my visit, Lance Bishop, Chief Surveyor for the BLM in California and an OIT graduate, was the sole California representative on the IAC. In July of 2007, the CLSA Board of Directors endorsed my offer to be an IAC liason.

### Ties with the Bureau of Land Management

The BLM estimates that 60% of its workforce consists of graduates of the OIT Geomatics program. Much of this workforce is the result of a cooperative education program that the BLM started in the 1970s. The BLM recently strengthened its ties to OIT by founding the first endowed chair at OIT in 2005, a faculty position filled by Tim Kent. Tim's duties include substantial recruiting efforts, including efforts to recruit Native American youth into the Geomatics field. Tim and his Geomatics students have also been visiting high schools, and he even adapted one of the freshman Geomatics courses for use in a high school setting.

Continued on next page



Joe at DPW

**For more information go to:**

<http://www.oit.edu/programs/geomatics>  
and

<http://www.oit.edu/Default.aspx?DN=f40df237-a3d6-47b9-82d7-ca5e09262fe4>

**Michael D. Pulley, PLS** is a principal in Points West Surveying Company, a private firm offering land surveying consulting services. He is licensed in California and Oregon, and is a past president of, and current Chapter representative for, the Humboldt Chapter of CLSA.



Mike Pulley, PLS

**Future is Bright**

OIT has a strong PLSO student chapter, with a record number currently attending meetings and elections. Members are active in attending national events such as American Congress on Surveying and Mapping conferences and a recent hydrographic conference in Norfolk, Virginia. With so many good people dedicated to its success, the future is bright for the Geomatics curriculum at Oregon Institute of Technology. ✦

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# Working Professionals Train Next Generation of Surveyors **The Santiago Canyon College Surveying and Mapping Sciences Program**

By: Santiago Canyon College Surveying and Mapping Sciences Program Faculty



“**W**here have all the surveyors gone?” asked Michael Duffy, PLS, in a CLSA News article from 2005. “We know where the future ones are, at Santiago Canyon College!” says Bill Appleton, PLS, Surveying and Mapping Sciences program instructor at Santiago Canyon College (SCC), located in the City of Orange in southern California. The Surveying and Mapping Sciences program at SCC, offered for many years (beginning at Santa Ana College) has expanded over the past five years from 57 students enrolled per semester to 167 and growing! As the need for new surveyors becomes more urgent, SCC has expanded its recruitment efforts, and those efforts have paid off.

## Trig Star Events

Events such as the annual California Land Surveyors Association (CLSA) sponsored Trig Star bring hundreds of potential future surveyors from the high school ranks to the college each year. The next, and third, Trig Star event at SCC is on April 19, 2008. “We probably had one of the



biggest turn-outs for any Trig Star event anywhere”, says Jeremy Evans, PLS, CLSA Trig Star coordinator for Orange County and SCC program instructor. “We’re looking at an even larger event this year”, he continues.

SCC faculty and experienced local CLSA member surveyors visit high schools to both promote land surveying as a career choice and to encourage students to attend Trig Star events. “We encourage the parents to attend too, and invite them for the continental breakfast in the morning, the barbecue lunch and to participate in the Survey Challenge we’ve got set up where the kids – and parents -- get to use the field equipment”, says Don Mertens, PLS, SCC Surveying and Mapping program facilitator.



*Continued on next page*



## Outreach and Dedicated Faculty

The SCC outreach department regularly distributes both Trig Star invitations and surveying program brochures at high schools and community events. The college also mails semester class schedules to members of the surveying industry twice a year. *“Current professionals in a given field are always the best source of referrals to a career-training program. Through their own experiences, they know the industry ins and outs, what it takes to get a job, and what it takes to be successful. And, hopefully, the mailings guide local employers or managers to refer surveyors to SCC for preparation for LSIT and PLS exams”*, explains Tricia Evans, Dean of Career Education Programs at SCC.


SCC’s most valuable asset is its dedicated surveying faculty, all of whom are working professionals who are passionate about spreading the word on career opportunities in this challenging and growing field. Santiago Canyon College surveying faculty and field instructional assistants are full-time surveyors or engineers from throughout southern California, representing agencies and companies such as Caltrans, Psomas, Johnson-Frank & Associates, Port of Long Beach, and Stantec Engineering.

## New Class Offered

The SCC career education division is now offering a new class: Surveying Careers, an introduction to the opportunities in surveying. It is scheduled each summer, fall and spring. Its goal is to get students up-to-speed for the first course in the surveying program series, Plane Surveying (SURV 118).

Surveying Careers was offered for the first time in the summer of 2007 and was taught by Kimberley Holtz, PLS. Ms. Holtz is employed by Psomas, which hosts a field trip for the class. Special effort was made to recruit women and recent high school graduates but the class is, of course, open to anyone interested in exploring the field of surveying. *“With very few women in our current classes at SCC, we are missing half the population when it comes to generating interest in surveying as a career”*, says Ms. Holtz. Students learn about job requirements and characteristics, skills required, potential earnings, licensing requirements, local employers and the projected job market. They operate field equipment, such as total stations and GPS hand-held receivers. They try out AutoDesk CAD, mapping and GIS software in the computer lab, enjoy field trips, meet guest speakers, and have field-skill competitions. This course not only helps students identify whether or not surveying is the right career for them, but will also prepare them for future coursework in the certificate or two-year degree program. Of the 19 students who had enrolled in the first class, all completed it, and each one indicated a desire to pursue a surveying career.

Continued on next page



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“The reason we began this class is that in the basic Plane Surveying class we see the majority of students are already surveyors, or have had at least some experience in the field who are interested in LSIT exam preparation. This new course helps the beginner with a starting place to learn about the career, build confidence, experience a math assessment, and learn some of the math needed and receive an in-depth orientation to surveying” says Tricia Evans. “A rank beginner could be lost in the technical jargon, math applications, and in trying to catch up with those who bring even a small amount of experience to the class. We are making efforts to get people in who know little to nothing about surveying and let them decide if they are interested. With such a diverse choice of working conditions, excellent income and opportunity for upward mobility, it becomes a logical choice for many – which of course is great news for SCC, CLSA and employers”, she continues.



“We’re concentrating on training people for entry-level positions to meet the huge numbers that will be needed over the next decade,” says Jeremy Evans, PLS, who has been teaching in the program for over 25 years. Mr. Evans is also Vice President and Technical Director of Surveying at Psomas in Costa Mesa. “The low cost of a community college education, combined with the fact that many employers in both the private and public sectors offer tuition reimbursement, helps new surveyors get the skills they need and training to advance in their careers” he notes.

### Program Provides Excellent Foundation

The SCC Surveying and Mapping Sciences program provides a combination of classroom instruction and hands-on training using the latest software technology, including AutoCAD, ESRI for GIS and Microsoft Project. Field equipment used includes total stations, automatic levels and GPS hand-held receivers. All the classes are taught by licensed surveyors and qualified engineers who work in the fields that they teach. The SCC program provides an excellent foundation for anyone who wants to get started in surveying and mapping, or prepare for state licensing examinations. And compared with four-year universities, Santiago Canyon College’s comprehensive Survey and Mapping Sciences program is an excellent value at just \$20 per unit. Evening and Saturday classes are available to accommodate daytime work schedules, and more sections of the entry-level course are being added to accommodate growing interest.

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## The Education of Future Surveyors at Santa Rosa Junior College

By: Jerald P. "Jerry" Miller, PLS



The city of Santa Rosa is located 55 miles north of San Francisco and 30 miles east of the Pacific Ocean, deep in the heart of the Sonoma County wine county. As the story goes, one rainy evening in 1966, a group of local professionals got together and formed the organization now known as the California Land Surveyors Association (CLSA). Today, Santa Rosa is home to the CLSA Central

Office and the tenth-oldest of California's 109 publicly-funded, two-year community colleges, Santa Rosa Junior College (SRJC).

For over 40 years, Santa Rosa Junior College has trained and educated students for careers in the civil engineering and land surveying professions. The Civil and Surveying Technology program continues to supply local firms and agencies with qualified technicians in these disciplines. It is with great pride that SRJC has the distinction of being one of the best supported, instructed, equipped and funded programs of its kind in the state. Recently, the program was used as a model for new programs throughout the country.

SRJC offers a strong general education for students planning to transfer to four-year colleges and universities, as well as offering both an Associate of Science degree and a Career Certificate in Civil and Surveying Technology, with emphasis in either civil engineering or land surveying. SRJC also has a one-year certificate in Geographic Information Systems (GIS).

### Program Description

SRJC's two-year Civil and Surveying Technology program prepares students for technical positions in the civil engineering and land surveying professions. For the last fourteen years Jerry Miller has coordinated the program. Being the only full-time instructor, Jerry relies on the expertise of his adjunct instructors. These part time instructors are all dedicated professionals. All are registered civil engineers and licensed land surveyors with many years of experience in public and private industry.

Students study theory and also gain hands-on, practical experience at SRJC's outstanding facilities. Students use state-of-the-art equipment that includes total stations with data collection, static and RTK GPS receivers, AutoDesk Land Development Desktop and Civil 3D CAD software and ESRI's ArcView and ArcGIS mapping software. There is enough surveying equipment for eight surveying crews and two 24-seat, fully-equipped computer labs. Field exercises

*Continued on next page*







(ACSM), North Coast Builders Exchange (NCBE), Association of General Contractors (AGC) and Engineering Contractor's Association (ECA).

Students may earn an Associate of Science degree and a Career Certificate concurrently. The curriculum is organized so that students may meet the requirements for an Associate of Science degree in four semesters, as well as for the Career Certificate in Civil and Surveying Technology. University transfer is an alternative for individuals who want to have a strong foundation to advance their surveying career. Students transferring to Fresno State University (FSU) have been very successful, graduating in the top 10% of their class. SRJC has also transferred students to Oregon Institute of Technology, Oregon State University, University of Nevada Reno and California Polytechnic Institute, San Luis Obispo.



are performed on the 100-acre campus located in the heart of Santa Rosa, or on the college's 365-acre farm 17 miles northwest of the main campus.

The program is endorsed and guided by the Civil and Surveying Technology Program Advisory Committee. The committee includes prominent local representatives from public agencies, private industry, the American Society of Civil Engineers (ASCE), the California Land Surveyor's Association (CLSA), Consulting Engineers and Land Surveyors of California (CELSOC), Northern California Section of the American Congress on Surveying and Mapping

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## Program Requirements for Land Surveying

EmphasisThe program sequence typically begins in the fall semester. However, a student may choose to begin the program by enrolling in required courses offered in the spring and summer semesters. The first year of the program consists of core courses dedicated to equipping students with the basic skills necessary for successful job performance.

The first semester classes consist of manual drafting, introduction to AutoCAD, and introduction to plane surveying, college algebra/trigonometry, and a non-technical skills class. The second semester students enroll in introduction to civil engineering CAD, introduction to GIS, trigonometry/pre-calculus, and plane surveying applications.

Prior to the second year of the program, students choose an emphasis—either Civil Engineering or Land Surveying. Courses in this half of the program allow



students to specialize in a particular discipline within the Civil and Surveying Technology field. Students must choose their emphasis prior to enrolling in second-year courses.

The third semester classes for the land surveying emphasis consist of route surveying and design, evidence and procedures for boundary determination, and a discipline elective. The fourth semester students enroll in introduction to GPS, boundary control and legal principles, and a discipline elective. The discipline electives that a student can choose from consist of advanced GIS, advanced civil engineering CAD, subdivision planning, photogrammetry, public works design, soils and materials testing, work experience/internship or an independent studies course.

A Career Certificate is awarded upon the fulfillment of 44 units of the Civil and Surveying Technology program with a grade of “C” or better. Completion of an additional 19 units is required to receive an Associate of Science degree in Civil and Surveying Technology-Land Surveying. The additional courses required for an Associate of Science degree consist of English composition, natural, social and behavioral sciences, humanities, American government and culture studies.

## Program Outreach

Since 2002, SRJC’s surveying students have hosted the county-wide Trig Star competition. Sponsored by the local CLSA and CELSOC chapters, high school students from all public and private schools are invited to participate. This year’s state champion was Ian Vonseggern from Santa Rosa High School with the only perfect score! This event has slowly grown into a much-anticipated event for local professionals, students and their teachers.



Our outreach for students begins with the visits to elementary, middle and high schools in the county to make presentations. Active participation in career fairs and industry functions, and the stellar support of local CLSA chapters, has made the program what it is today. Virtually every firm and local agency has graduates from this program. Some firms boast 100% of their staff are graduates of SRJC!

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## Who's Enrolling?

Many of the students currently enrolled in our program are quite nontraditional. The majority are locals who choose to attend a school near home and find out about the educational programs in various ways. A lot of them Google our website, and we get a lot of cold calls. They know somebody who knows somebody whose uncle's brother who was a surveyor. They respond with "it looks like a cool job", and we all know it is!

Our program offers flexibility for a wide variety of surveying students. Many of the students have previous professional experience. The average student age is 32, but it runs the gamut from 18 to 58. We have a real mix of students. About 30 percent are women. Many of our students are pursuing a second career. The "high-tech crash" supplied us with an influx of students with a scientific background.

Currently, we have 65 full time students enrolled in the first and second year of the program. Approximately 12 part-time students are also enrolled in courses in the program. We have graduated 20 or more students for the last four years. All graduates have found employment with multiple job offers. A large percentage of the students gain full time employment by the end of the third semester and return in the evening to complete the final semester classes. Of the students choosing to take the Land-Surveyor-In-Training Examination (LSIT), 75% pass on their first attempt!



Paying for college isn't as expensive as people might think. As is the case with other California community colleges, SRJC's is a bargain at \$20 per unit. SRJC is also fortunate to have extensive scholarship and financial aid programs that provide more than \$17 million annually to all SRJC students. SRJC's prestigious Doyle Scholarship Program, funded by the Doyle Trust, is the only one of its kind in the country. Each year incoming freshmen and continuing college students receive Doyle scholarships ranging from \$1000 to \$1600 per year, regardless of need. Scholarships provided through the generosity of donors to the Santa Rosa Junior College Foundation, and the college's financial aid program, mean that no student is denied a college education because of financial need. Individuals and local chapters of CLSA, CELSOC, ACSM, ASCE, ECA, AGC and NCBE have been very generous with over \$15,000 in scholarships earmarked for civil engineering, land surveying, and construction students.

Widely regarded as one of the finest community colleges in the state, Santa Rosa Junior College is known for its academic rigor, its outstanding vocational training programs, superb faculty, comprehensive student services, and excellent facilities. At SRJC we focus on the student, and the successes that our students have achieved are evidence of that attention. It is put best by Dr. Robert F. Agrella, President of SRJC: "I can assure you that if you make SRJC your first choice, you have chosen the best!" I encourage you to visit Santa Rosa Junior College to see for yourself what SRJC has to offer." Forty years and counting...we must be doing something right!



For more information contact Jerry Miller at 707-527-4376 or email [jmiller@santarosa.edu](mailto:jmiller@santarosa.edu) or check out the website at [www.santarosa.edu/certificates](http://www.santarosa.edu/certificates)

**Jerald P. "Jerry" Miller, PLS**, has been the program coordinator for the Civil and Surveying Technology program at Santa Rosa Junior College since 1993. He is a graduate of California State University, Fresno, with a Bachelor of Science degree in Surveying and Photogrammetry. Jerry is also the Vice Chair of the Northern California Section, ACSM, and is an active member of the Sonoma County Chapter, CLSA. He is a frequent guest speaker for many professional engineering and surveying societies and organizations. Those fortunate enough to participate in his presentations, courses or PLS exam workshops enjoy his upbeat and humorous style.✚



By: Greg Helmer, PLS

# Advancing to Network RTK

As surveying technology has advanced from early GPS methods using static receivers to continuous GPS sites, from RTK with radios and cell phones to wireless internet protocol, from Global Navigation Satellite Systems (GNSS) to network RTK broadcasts, it's important to note that each method works in basically the same way. A GNSS receiver intended for surveying purposes "tracks" the carrier signals transmitted from multiple satellites and multiple frequencies. By tracking, we mean that the receiver counts whole wavelengths of the radio wave as they pass the antenna, and the fraction of a wavelength at an instant in time (measurement epoch). The receiver does this for each visible satellite on each of the carrier frequencies broadcast. This is in addition to tracking the code signals modulated onto the carrier wave that are fundamental measurements for conventional GNSS. In GNSS solutions, carrier phase measurements at the roving receiver are matched with similar measurements at a base receiver and processed by double-differencing measurements between receivers and between satellites. Successful double-difference processing derives a vector (the difference in X, Y & Z coordinates, together with their respective levels of certainty) between the base and roving receivers with centimeter accuracy. While a GNSS receiver does an amazing job of tracking the carrier signal, rarely missing a decimeter-long wave passing at the speed of light, it has no knowledge of the whole number of wavelengths between the receiver and satellite at the moment that it started tracking. This integer bias term is a critical variable in the double-difference algorithm. Every advance in surveying technology has attempted to reach successful resolution of the integer terms faster and with more reliability. In general, if you get the right integers, you will get the right vector answer. If you fail to resolve the integers, you will certainly have a sub-standard vector.

The above should be familiar to anyone who has progressed from static GPS to RTK GPS. The RTK handheld announces that it has "lost initialization" and one must either go back to a known point (a good quality control procedure by the way), or allow the data collector enough time to once again resolve a new set of integer terms. This standard RTK mode can be accomplished by transmitting the base receiver data to the roving receiver data collector via radio modem, cellular modem, or by wireless Internet protocol. The distinction for standard RTK being that there are only two receivers used to determine a single-baseline solution. Of course a great many refinements to the data stream and processing are possible such as the addition of geoid modeling and site calibrations, or ionospheric-free solutions, or multiple GNSS satellite constellations. Regardless of the communication protocol and refined data streams, standard RTK mode is a single-baseline solution with all of the limitations found in static methods. Network RTK, the latest innovation for GNSS surveying, leverages GNSS continuous arrays and continual processing of the network in real time to develop improved models for orbits, ionosphere and network integer biases. Processing of the network is accomplished on the server side, and processing of the final double difference vector to the roving site can be accomplished by the server or at the rover end. Therein lies a unique difference in network RTK approaches.

## Four components make up a network RTK system:

- 1) A continuous GNSS receiver array provides the raw code and carrier phase observables for the base stations. The array is often provided from existing permanent sites such as the Plate Boundary Observatory, or can be from an assemblage of ad hoc volunteers with available receivers and rooftops, or an agency or a commercial vendor may endeavor to permit and construct the necessary facilities.



California Real Time Network  
California Continuous GPS Sites


Over 50 sites in the California Spatial Reference System broadcast real-time GPS data

Below: How many surveyors and receivers are needed to figure out Network RTK? Ask the Metropolitan Water



Continued on page 34





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## Advancing to Network RTK

An important consideration for the GNSS receiver array is the geodetic reference frame for the network. An ad hoc network is less likely to include the rigorous processing and documentation necessary to be included in the California Spatial Reference Network and thereby become a basis for work regulated by the Public Resources Code (i.e. State Plane Coordinates).

2) Communications infrastructure must be in place to package the receiver data into a suitable data stream and transmit it to a central processing facility. Data transmission is often accomplished over multiple protocols including radio modem, cellular modem, wired Internet, or microwave networks. Compiling the network of antennas, communication systems and the various levels of permission to utilize them on a continuous basis is one of the greatest challenges for many potential RTK networks. The necessary communications infrastructure may also include hardware and software on the receiver end to reformat the data stream or to provide additional data security to the station owner prior to streaming over wireless. At the central processing facility there may also be hardware and software to manage the data stream passing it through a firewall for network processing.

3) The network RTK server has the job of receiving data streams from the array, processing the network parameters, and serving the processed information over the Internet. While modern GNSS receivers are able to store and stream data in various formats, and the open-source NTRIP software is able to handle routine data flow, software for network processing on the server is manufacturer-specific. And along with that comes various approaches to network RTK. Without considering the merits of Virtual Reference Stations©, instantaneous (Epoch-by-Epoch™) integer resolution, or integrity monitoring, network RTK software can loosely be divided into solutions where the baseline(s) and rover coordinate processing takes place on the rover side, and (“inverse” network RTK) solutions where all processing takes place at the server and a final geodetic coordinate in the network reference frame is served to the rover.

4) The user component includes the rover receiver, data collector/processor and wireless Internet capability. In the case of commercial subscription services, the user may also need the network key from a paid subscription to access the Internet data stream from the server.

Rover-based network RTK functions similar to conventional RTK. Base station data flows via wireless communication to be differenced with data from the roving receiver in a field computer data collector. The base station data may have been modified to incorporate network-processing parameters, but as a minimum the data flow includes raw carrier-phase data together with additional data records to minimize distance dependent errors and assist with integer resolution at the rover. Modern versions of the standard RTCM (Radio Technical Commission for Maritime Services) format include message types 1014 – 1017 specifically designated for network RTK. Rover-based network RTK provides a working environment easily compatible with a variety of data collectors and software.

Server-based network RTK uses two-way communication between the rover and the server, with carrier-phase observations being sent from the rover to the central processing center, and computed positions, in the network reference frame, sent from the



*How many surveyors and receivers are needed to figure out Network RTK? Ask the Metropolitan Water District of Southern California, who recently hosted a Network RTK users group meeting.*

*Right: Not all base antenna are constructed to the same standards.*



server to the rover. This configuration uses the robust processing capability at the server to provide a comprehensive network solution. The geodetic position served can be further manipulate at the rover or by the server to include geoid modeling, site calibrations, or plane coordinate transformations.

### Considerations and Misconceptions to Network RTK:

- ❑ Regardless of the methodology and software solution, network RTK is still very similar to GNSS surveying with many of the same limitations and cautions. Antenna heights, antenna models and multipath can introduce nuisance errors. Site calibrations can easily mask blunders. Satellite masking can disable a survey. And, bad integer solution equals bad answer.
- ❑ Strong and dependable wireless Internet is critical. Research the service providers in your local area before signing a service contract. Keep wireless modem software up to date. Reliable communication is the weak link in network RTK. A number of field problems have been traced to nuances in the wireless communication system.
- ❑ Raw GNSS observation data comes in many flavors. Code-phase pseudo-ranges, manufacture-specific carrier-phase files, RINEX and RTCM formats all contain raw GNSS observables. This is easier said than done, but understand what observation data the network is serving, and what observation data is expected for the network solution. ❖

### Links to further network RTK resources:

#### California Real Time Network (CRTN)

<http://sopac.ucsd.edu/projects/realtime/NTRIP> Open Source Software <http://ntrip.org/>

#### RTCM Data Format Standards

<https://ssl29.pair.com/dmarkle/puborder.php?show=3>

#### California Spatial Reference Center

<http://csrc.ucsd.edu/>



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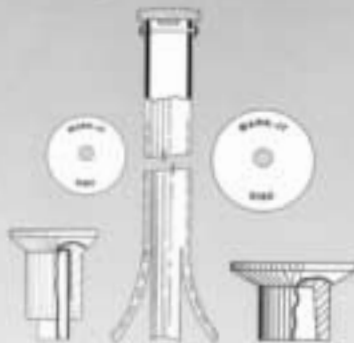
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# Q&A SMA Expert

## Question:

John McDonough, PLS, has asked for an explanation of the process for extending the life of a Tentative Map through the use of multiple (phased) Final Maps, and how this extension relates to other Tentative Map extensions under the Map Act.

## Answer:

### 1. Multiple (Phased) Final Maps

Generally, a subdivider will secure a Tentative Map covering all the property to be subdivided, and then will seek a single Final Map covering the entirety of the area contained in that Tentative Map. However, if the subdivider can satisfy certain Map Act requirements (explained below), the Map Act not only allows the filing of a Final Map on only a portion (a phase) of the total area encompassed by the Tentative Map, but the filing of that "phased" Final Map also extends the life of the remaining portion of the land staying in Tentative Map status (the area not included in the phased Final Map): the filing of each Final Map extends the life of the underlying Tentative Map by three years for up to a total of ten years. This process is generally referred to as filing "multiple" or "phased" Final Maps.

A subdivider who wishes to use multiple Final Maps for the purpose of extending their Tentative Map must satisfy all of the following:

**1.** Notify the city or county of its intent to use multiple (phased) Final Maps at the time the Tentative Map is filed; if the subdivider notifies the city or county of his or her intent to file multiple Final Maps after the filing of a Tentative Map, the city or county must agree to the filing of multiple Final Maps. Gov't Code § 66456.1. (Solution if city or county fails to agree: Withdraw application and reapply with the notice now provided.)

**2.** Have a project that will expend one hundred seventy-eight thousand dollars (\$178,000) or more to construct, improve or finance the construction of public

improvements outside the property boundaries of the tentative map (offsite), excluding improvements of public rights-of-way which abut the boundary of the property to be subdivided. "Finance" would include impact fees paid at building permits to fund offsite public improvements.

Again, if both requirements are satisfied, then the filing of each Phased Final Map extends the life of the underlying Tentative Map (for the area not included in the phased Final Map) by three years for up to a total of ten years. Additionally, other Tentative Map extensions are available (see discussion below) beyond that 10-year period.

A city or county may impose reasonable conditions relating to the filing of each such Phased Final Map (those conditions that must be satisfied to file each Phased Final Map). Gov't Code § 66456.1. Subdividers should work with the city and county to determine which conditions should be satisfied with each phase.

As to the questioner's inquiry about the statutory cost requirement for public improvements, the statutory requirement was \$178,000 as of 2005, and is increased each year by the State Allocation Board in accordance with cost-of-living increases. The current required amount can be obtained from the State Allocation Board.

### 2. Other Tentative Map Extensions Available Under the Map Act

In addition, several other extensions of the life of a Tentative Map are available under the Map Act, and these extensions are not mutually exclusive; that is, a subdivider may secure multiple extensions of time under the various different extension provisions of the Map Act. *California Country Club Homes Ass'n, Inc. v. City of Los Angeles*, 18 Cal.App.4th 1425 (1993).

#### These other extensions are as follows:

**Development Agreement** – a Tentative Map on property subject to a statutory "Development Agreement" may be extended for a period of time specified in the Development Agreement, which specified period cannot

*Continued on next page*




# Q&A SMA Expert

exceed the term of the Development Agreement itself. Gov't Code § 66452.6(a)(1).

**Development Moratorium** – the life of a Tentative Map is automatically stayed for up to a maximum of 5 years during a “development moratorium” that is imposed after a Tentative Map is approved. Gov't Code § 66452.6(b). A development moratorium can include moratoria based on infrastructure constraints (e.g., sewer, water), as well as other actions of public agencies which regulate land use, development or services.


**Litigation** – a pending lawsuit involving the approval or conditional approval of a Tentative Map can stay the life of a Tentative Map for up to 5 years. However, unlike a moratorium, the litigation stay must be approved by the city or county that approved the Tentative Map.

**Discretionary Extensions** -- Upon application by a subdivider, a city or county may extend the life of a Tentative Map for a period of time not to exceed five years. Gov't Code § 66452.6(e). ❖



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# 21st Meeting of the North American Surveying & Mapping Educators Conference



## In the Beginning

In 1937, the Society for the Promotion of Engineering Education (SPEE) sponsored a gathering of the leading surveying-engineering professors of the era to discuss the future of surveying education and the surveying profession. This first event, called the Surveying Teachers Conference, included professors from leading universities all over the nation. Many of these professors were the authors of the surveying textbooks of the day. This first event has been credited as the impetus that eventually created the American Congress on Surveying and Mapping, ACSM, in 1941. SPEE later became the American Society for Engineering Education (ASEE), and after 1971 eliminated the Surveying and Geodesy committee, and consequently, sponsorship of the National Surveying Teachers Conferences.

## 2007 Conference Well-Attended

The 21st meeting of the North American Surveying & Mapping Educators Conference was held at Ferris State University, July 11th through July 13th, 2007. Although this group has been meeting since 1937, it has been a largely unofficial entity since 1971 when sponsorship by the ASEE ceased. ACSM has provided some funding more recently, however the Surveying & Mapping Educators group has existed independent of professional organizations. This year the attendees comprised a virtual Who's Who in land surveying education, and included faculty from schools across the country: Ferris State University, Texas A&M, New Jersey Institute of Technology, Oregon Institute of Technology, Purdue University, University of Maine, Great Basin College of Elko, NV, University of Mississippi, Metro State College at Denver, CO, Institute for the application of Geospatial Technology, Cayuga Community College, Idaho State University, California State University, Fresno, University of Florida, University of Alaska, Michigan Technological University, Iowa Western Community College, University of Puerto Rico, Tyler Junior College, University of New Mexico, Renton Technical College, Columbus State Community College, East Tennessee University, North Carolina A&T State University, Cincinnati State Technical & Community College, and Pennsylvania State University. Attendance by the University of West Hungary brought an international perspective to the conference. Conference sponsors included Trimble Navigation, Leica Geosystems, Land Surveyors Workshops, and Falk PLI Engineering and Surveying, Inc.

## Multiple Topics of Interest

Featured topics at the 2007 North American Surveying & Mapping Educators Conference included:

## Incorporating Emerging Technologies Into Existing Curriculums

Effective strategies for teaching applications in: laser scanning, network RTK, GPS, GIS, airborne LiDAR, and Global Cogo.

## Integrating Surveying/Mapping/Geomatics Curriculums with other Disciplines

Merging of GIS and surveying curriculums, land surveying options in multidisciplinary engineering programs, partnering between geodesy and computer science curriculums, and the potential for dual bachelor's and master's degree programs that emphasize land surveying.

## Distance Learning and Continuing Education

Internet-based degree programs with lab exercises proctored by a participating PLS, marketing of distance learning options to universities, colleges, businesses and government agencies, video programs for distance learning, and recent research on the effect that mandatory professional development has on practice quality and competency.

## Student Recruitment

Strategies for increasing enrollment and the status of bachelors and graduate degree programs, establishing high school recruitment programs, fostering relationships with community colleges, and effective marketing of the land surveying profession.

## Program Accreditation

Determining course content, challenges in producing well-rounded graduates, implementing accreditation standards, determining levels of competency, preparing students for professional licensing and success in the workplace.

## Building Program Support

The critical need for scholarships, the value of student conferences, partnering between educational institutions, establishing marketing and recruitment committees among professional societies, pursuing support from leadership in government.

## Sharing of Ideas for Academic and Professional Improvement

The need for more participation by four-year programs, the need for more representation of community colleges, opportunities for building mutually beneficial partnerships between academia and industry and professional societies, encouraging participation by high school educators, creating successful workshops at state and national conferences.

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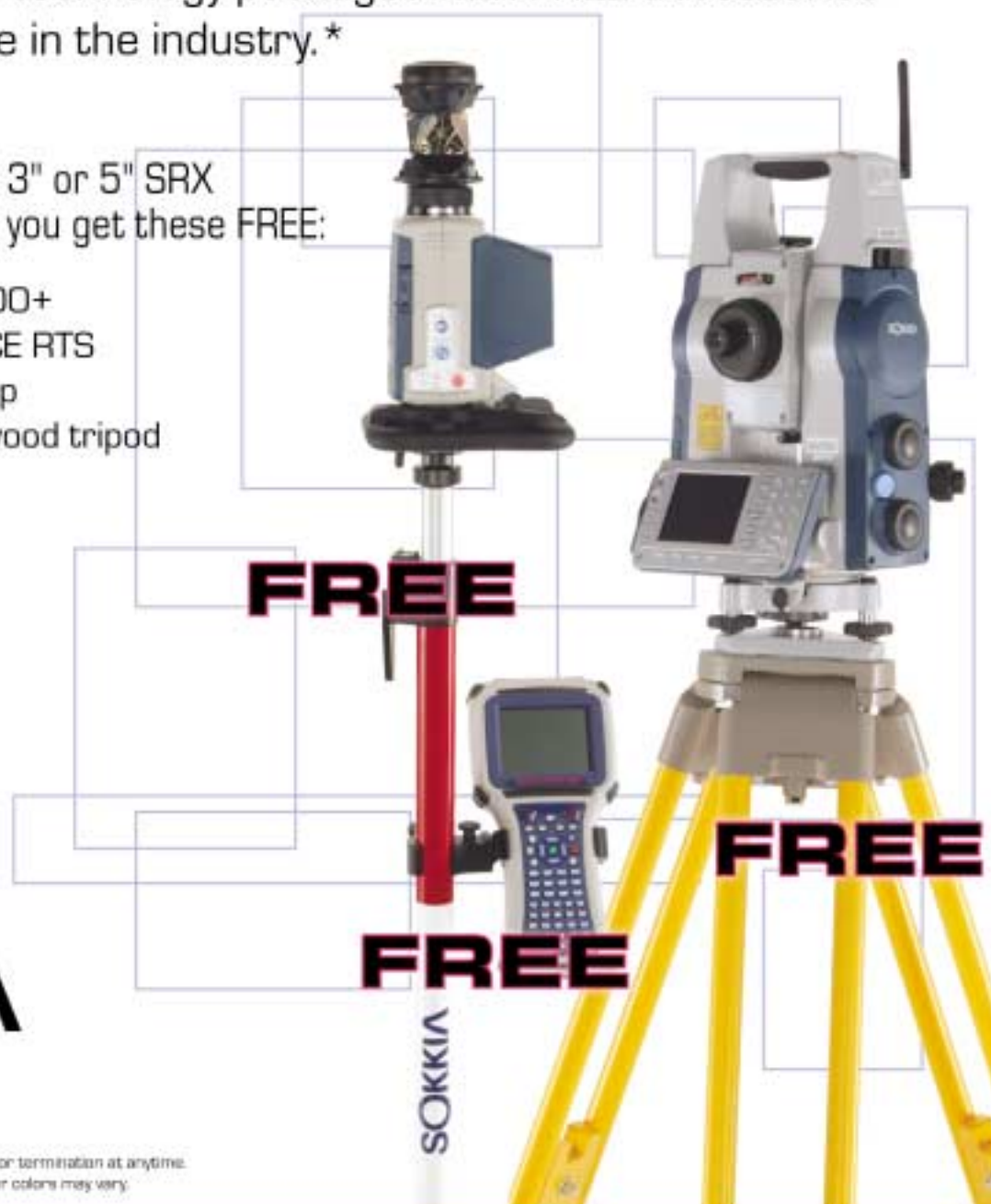
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## Closing Thoughts

Those in attendance included the academicians who once said Some day, you will be able to get centimeter positioning from GPS in real time. Many of us thought I don't want to carry that big, heavy, yellow box, an antenna, a tripod, and a car battery around all night long! Times are changing and they're changing fast. Your involvement can help build a brighter future for the surveying profession.❖

*Robert M. McMillan, PLS, is Chief of Survey Standards, Division of Right of Way and Land Surveys, California Department of Transportation.*

## Captions

- 1 - Robert Curley, University of Alaska
- 2 - Robert Liimakka, Michigan Technological University
- 3 - Donny Sosa, ESRI
- 4 - Michael Sizer, Iowa Western Comm. College
- 5 - James Bethel, Purdue University
- 6 - Amy Work, IAGT.org
- 7 - Peter Kuntu-Mensah, Texas A&M Corpus Christi
- 8 - Steven Johnson, Purdue University
- 9 - Ismael Pagan, University Puerto Rico
- 10 - Joseph Paiva, University Missouri Rolla
- 11 - Sep Humphries, Ferris State University
- 12 - Mason Marker, Oregon Institute of Technology
- 13 - Jeff Olsen, National Geodetic Survey
- 14 - Marv Myers, Ferris State University
- 15 - Herb Stoughton, Metro State College
- 16 - Chris Pearson, National Geodetic Survey
- 17 - Rich Vannozi, University of Maine, Orono
- 18 - Mike Falk, Falk PLI Engineering — Surveying
- 19 - Laramie Potts, New Jersey Institute of Technology
- 20 - James Elithorp, Great Basin College
- 21 - Patti Williams, Tyler Junior College
- 22 - David Wedlock, Ctr of Geographic Sci - Geomatics Dept
- 23 - Steven Frank, University New Mexico
- 24 - Carlton Brown, University of Maine, Orono
- 25 - Robert Schultz, Oregon State University
- 26 - Martin Paquette, Renton Technical College
- 27 - Khagendra Thapa, Ferris State University
- 28 - Marcus Bela, University of W. Hungary
- 29 - James Plasker, Ole Miss
- 30 - Bob Burtch, Ferris State University
- 31 - Rajendra Bajracharya, Idaho State University
- 32 - Ken Wong, St Cloud State University
- 33 - Curt Summer, ACSM
- 34 - Rob McMillan, CLSA
- 35 - James Crossfield, CA State University Fresno
- 36 - Maher Wiss, Idaho State University
- 37 - David Gibson, University of Florida
- 38 - Larry Phipps, Land Surveyors Workshops
- 39 - Sayed Hashimi, Ferris State University
- 40 - Bob Mergel, Columbus State Community College
- 41 - John Keen, Land Surveyors Workshops
- 42 - John Fenn, Fenn and Associates
- 43 - Earl Burkholder, University New Mexico
- 44 - Stacy Lyle, Texas A&M Corpus Christi
- 45 - Peggy Fersner, North Carolina A&T State University
- 46 - Dave Rigney, National Geodetic Survey
- 47 - Alfred Leick, University of Maine, Orono
- 48 - John Bossler, National Geodetic Survey
- 49 - Yaron Felus, Ferris State University
- 50 - Charles Ghilani, Penn State University
- 51 - Carol Morman, Cincinnati State Technical & Community College
- 52 - Joshua Greenfield, New Jersey Institute of Technology
- 53 - Marian Clark, East Tennessee University
- 54 - Thomas Seybert, Penn State University




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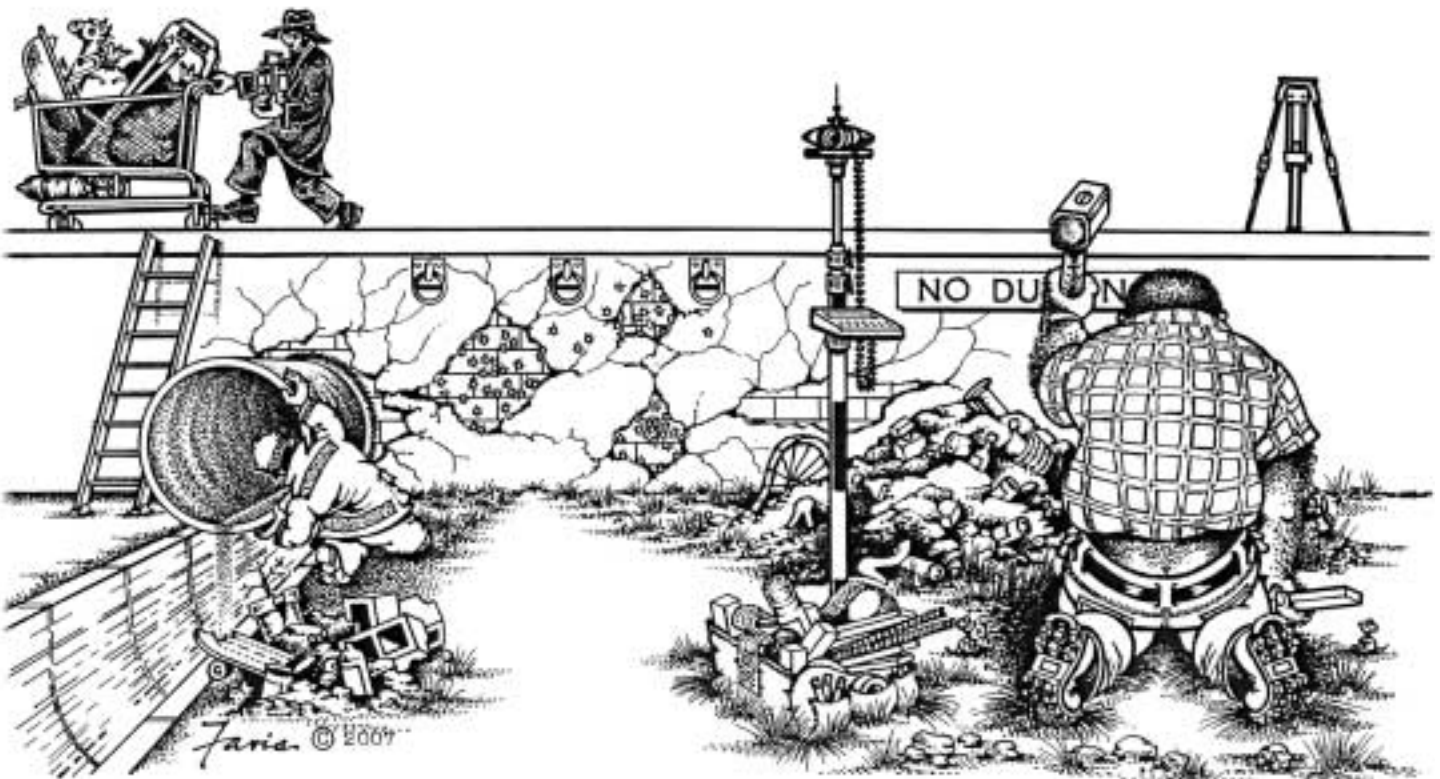
[www.californiasurveyors.org](http://www.californiasurveyors.org)

# Postcards

**Danae and Danica Hooper,  
with their assistant Dankey, in  
Imperial County, California.**

Their father, Dan Hooper, PLS, began putting them to work as soon as they were old enough to retrieve equipment from the truck. Danica has been operating the instrument for about two years, and says she enjoys boundary surveys more than topographic surveys. I m with you, Danica! - Editor

*Submitted by Dan Hooper, PLS,  
owner of Hooper Land Company  
in Fallbrook, CA.*





# TRIGSTAR... Easy, Fun & Rewarding!

The TrigStar Program Contest is an annual high school mathematics competition sponsored by the National Society of Professional Surveyors based on the practical application of Trigonometry. The program recognizes the best students from high schools throughout the nation.

## The purpose of the TrigStar Program:

- ☆ To promote the study of trigonometry in high school and to promote excellence in the mastery of trigonometry by honoring the individual student who has demonstrated superior skill among classmates at the high school level.
- ☆ To acquaint the high school trigonometry students with the use and practical application of trigonometry in the surveying profession.
- ☆ To build an awareness of surveying as a profession among the mathematically-skilled high school students, career guidance counselors and high school math teachers

## Trigstar Contest Levels:

- ☆ Level 1 is given at local high schools. There is one winner from each participating high school.
- ☆ Level 2 is the national test. The state winner from each participating state is eligible to compete for the National Trig-Star title

## How the Program is Implemented:

- ☆ The program begins with a presentation by a Land Surveyor to help participants understand the land surveying profession.
- ☆ A timed examination is administered during which students must solve trigonometric problems that incorporate the use of the right triangle formulas, the law of sines, and the law of cosines. The student with the highest score and fastest time will be named the "TrigStar" for each high school participating in the program. The scores and times of the Trig Stars are reviewed to determine the State Winner and Runner-up in California. The State Winner will qualify to take the National Exam.

## TrigStar Timeline:

### September – December

- Contact Schools

### December – January

- Finalize & Confirm Presentation Date

### February – April

- Give Presentation & Administer Exam

### April – May

- Awards & Recognition
- Submit Items to State Coordinator

## Get Involved!

The California Land Surveyors Association is encouraging you to join us in this opportunity to strengthen the land surveying workforce in California as well as promote public awareness of the land surveying profession.

*CLSA has numerous resources available to assist volunteers including:*

- Guidelines & Rules
- Testing Dates
- Sample Letters
- Video & PowerPoints
- Posters
- Plaques & Certificates
- Sample Press Releases ❖



### To volunteer or for more information contact:

**Aundrea Tirapelle**, CLSA Trig-Star Coordinator  
atirapelle@rbf.com

or

**CLSA Central Office**  
clsa@californiasurveyors.org



### Trig-Star Winner

Congratulations to Ian Vonseggern. Ian was the California Trig-Star winner and also placed 6th in the national contest.

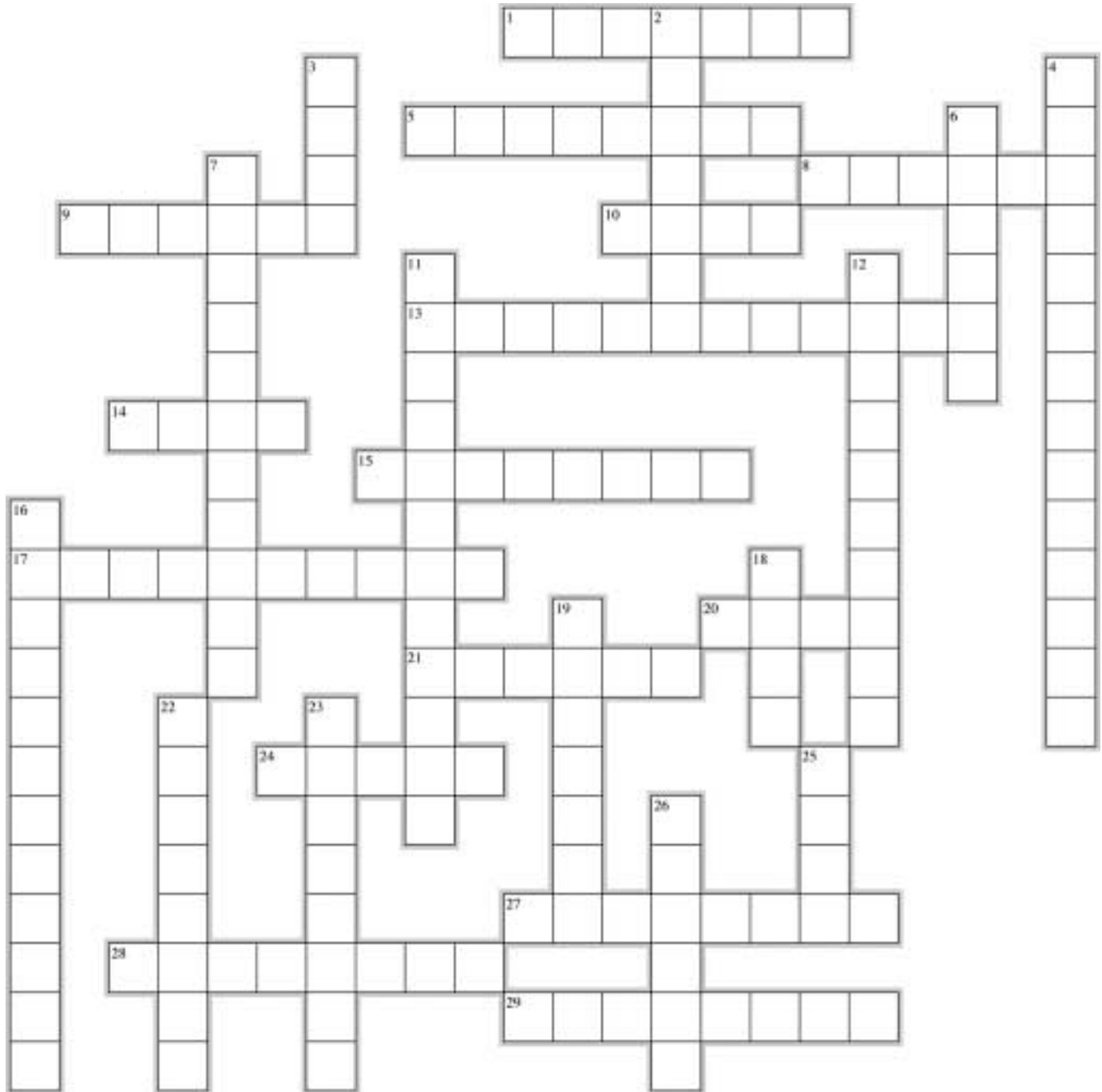
L to R, Noreen Carvolth, President of the Santa Rosa City Schools Board of Directors, Ian Vonseggern County, California Trig-Star Winner and Jerry Miller, PLS, Sonoma County Chapter Trig-Star Chair, SRJC Civil & Surveying Technology Program Coordinator



# Crossword Puzzle

By: Ian Wilson, PLS

## CLSA Crossword Puzzle #5



**Ian Wilson, PLS** is the president of Ian Wilson Land Surveying, Inc., in Temecula, CA. His practice specializes exclusively in boundary and topo surveys. He has worked in both private and public sectors for small firms in California and Caltrans, respectively. As well as being a licensed land surveyor, he and his wife, Laura, are newly certified SCUBA divers. They are looking forward to "getting wet" on future trips along coastal California and around the world.



## Across

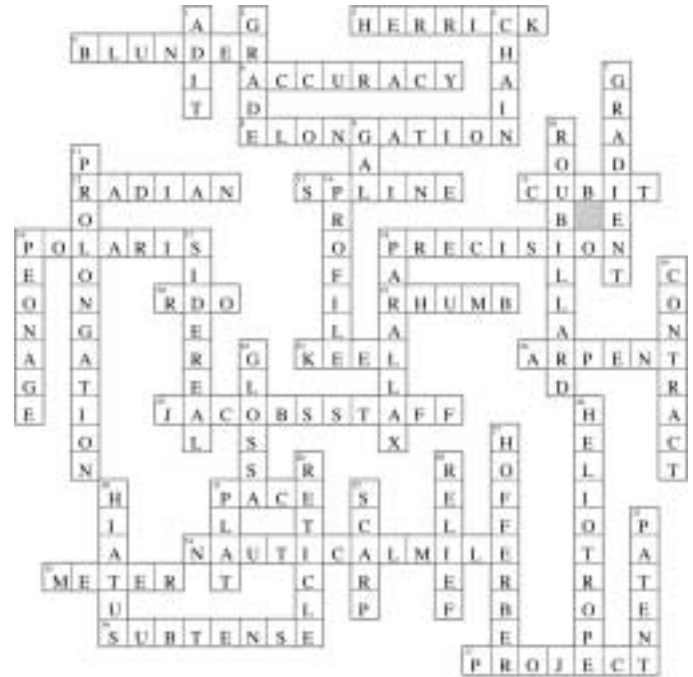
1. ASSUME BEFORE HAND
5. JUDICIAL ORDER TO A CORPORATION
8. COMMIT TO WRITING
9. GRANT OF PRIVLEDGE
10. SUBJECT FOR ARGUMENT
13. FRIENDLY BRIEF (2 WORDS)
14. JUDICIAL ORDER
15. COMMAND TO APPEAR
17. OMISSION TO DO DO SOME ACT
20. PURCHASE FOR TEMPORARY USE
21. JUDICIAL INTERPRETATION
24. FORD OR WADING PLACE (ANCIENT)
27. DISUPT THE SUFFICIENCY OF THE COMPLAINT
28. JOIN HEIR IN LANDS
29. FINANCIAL INTEREST IN THE LAND

## Down


2. ORDER TO APPEAR
3. LEGAL PROCEEDING
4. USE OF FACT ALREADY KNOWN TO THE COURT (2 WORDS)
6. ONE WHO HAS USE WITHOUT POSSESSION
7. TESTIMONY NOT IN OPEN COURT
11. WRIT DEMANDING PRESENTATION IN COURT (2 WORDS)
12. PENDING SUIT (2 WORDS)
16. UNLAWFUL INTRUSION
18. DEPOSIT IN OFFICIAL CUSTODY
19. PERSONAL PRIVELEDGE TO USE THE PROPERTY OF ANOTHER
22. UNLAWFUL ENTRY
23. RIGHT OF USE OF THE PROPERTY OF ANOTHER
25. SILENT
26. JUSTICE BASED ON FAIRNESS

## Key to CLSA puzzle #4

(Surveyor Issue # 151)



If you have an idea for a puzzle theme or a clue you would like to include in an upcoming puzzle, email to [crossword@californiasurveyors.org](mailto:crossword@californiasurveyors.org)



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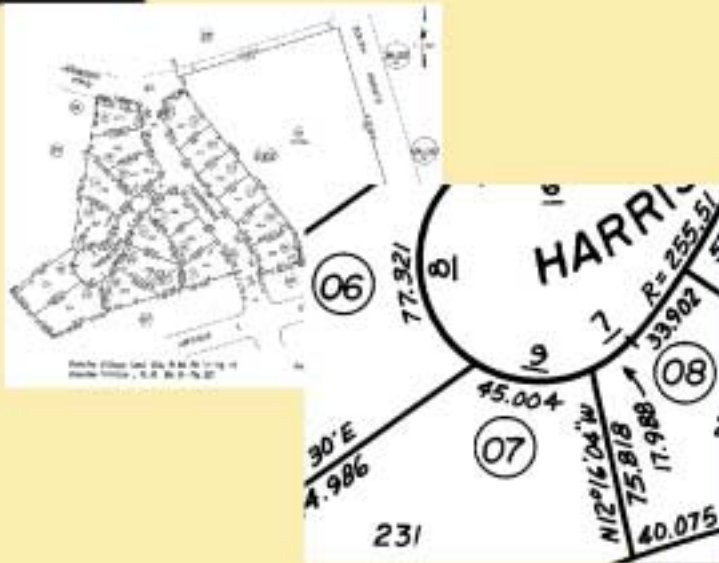
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## RISK MANAGEMENT FOR LAND SURVEYORS

# If You Missed the CLSA San Diego Convention Risk Management Panel

Here are some highlights from the Risk Management presentation at the Rancho Bernard CLSA-WFPS Conference on April 18 where Richard Andrews, CE, a Zurich Insurance Loss Control Engineer, presented a professional liability slide show and was assisted by Cathy Rizo, a Zurich Insurance Underwriter and me, your CLSA Insurance Broker.

### Risk Management

Using a Power Point Presentation, Andrews outlined the types of risk and goals of risk management and how to follow the five steps of risk management:

1. Risk identification
2. Risk analysis of loss frequency and severity
3. Selection of appropriate techniques such as avoidance, retention, loss control and transfer
4. Implementation of selected techniques
5. Monitoring results

When allocating risk by contract, the general rule should be that all risk belongs to the Client unless transferred or assumed by the Land Surveyor. The basic principle is that the party that can best foresee the risk and control it should bear the risk.

### Standard of Care

Standard of Care was a major focus of the panel and audience discussion. It is the standard of performance and conduct by the Land Surveyor which the Client has a right to expect based on the Surveyor's professional standing. Statutes, case law, common law and generally accepted professional standards are considered. Small and large firms are likely to be held to the same standard of care but that standard might differ in specific regions. If the standard is not met, resulting injury or damages become the basis for legal liability. If the Land Surveyor meets the standard of care, then it becomes a defense against professional negligence claims. According to Andrews, a "C" student standard of care approach is acceptable. The courts will accept reasonable errors. Perfection is not required.

### Loss Prevention Based on Proper Selection of Projects

Here are five key elements to evaluate when considering loss prevention:

1. Past experience with the client.
2. Financial resources of the client.
3. Sophistication of the client.
4. Reasonableness of the client's expectations.
5. Existence of unusual requirements.

### Loss Prevention Based on Proper Preparation of Agreements

Further steps in loss prevention can be taken by preparing agreements that are:

1. Complete and accurate in reflecting your services and the obligations you have to other project participants.
2. Fair in the allocation of the risk you retain.
3. Consistent with other project documents

Perform your part of the agreement so as to minimize the potential for disputes. Recognize and resolve potential problems when they arise and before they develop into a dispute. Also, you should properly document significant events when they occur so that when problems arise they can be resolved quickly and cost-effectively.

### Client Assessment

Your objective assessment of the Client is important:

- \_ Is the client financially solvent and will they continue to be?
- \_ Do they have a history of filing lawsuits?
- \_ Are they willing to negotiate?
- \_ Have you worked with this client previously? What was your experience?
- \_ Do they have a reputation for making slow payments?
- \_ Do they understand that in order for the Land Surveyor to produce quality work he must have an adequate budget?
- \_ Does the client understand which professional services are insurable and which ones are not?
- \_ What do other references of this client say?

You should develop good client relationships with mutual respect, rapport and open communications and partnering that allows for good working relationships and dispute resolution. This will help smooth out any project disputes, contract disagreements and late payments problems when they arise.

### Professional Liability Loss Control Techniques Summarized

1. Develop a clearly defined scope of services.
2. Commit oral agreements to writing.
3. Thoroughly document all file activity.
4. Conduct peer reviews.
5. Maintain reasonable workloads.
6. Consult specialists, when necessary.
7. Conduct quality audits.

*Continued on page 51*



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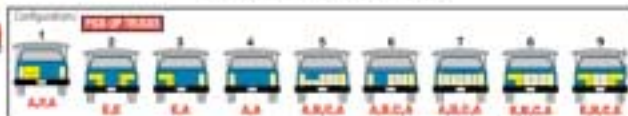
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The *California Surveyor* is a quarterly magazine written and edited specifically for land surveying professionals. Quarterly, it provides in-depth articles on issues affecting the profession as well as current events, and general interest articles. Our readers are members and non-members of CLSA. They are Land Surveyors in private practice and public employees, Land-Surveyors-in-Training, employees of title companies and other related industry professionals.

## FINDING THE MINDSET

Personal experience is probably your best source of article ideas. As a Land Surveyor, you have encountered problems, made mistakes and found solutions that can be shared with your colleagues. Have you worked on a unique project you would like to share with the profession? Do you have a fresh approach to an old problem or a cost-effective solution to a new one? Examine back issues of *The California Surveyor* to get a feel for the kinds of articles that are published and the way they are written. Visit the California Surveyor page on the CLSA website at [www.californiasurveyors.org/files/calsurv.html](http://www.californiasurveyors.org/files/calsurv.html). Before you write the article, feel free to write or call the editor to discuss your ideas.

## EVALUATION & ACCEPTANCE

All articles submitted will be reviewed by the editor. We may accept your article outright, accept it for a staff rewrite, or accept it contingent on your revision. Your writing style is your own, and we make every attempt to preserve it as we prepare your article for publication. But we will try to make the copy as substantive and clear as possible. If your article is substantially revised, we will email you the edited version, and you will have approximately one week to review it and make any additional changes.

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Generally, articles should be between 500 and 4,800 words. Articles must be submitted digitally. Pictures must be sent as individual files at least 300 dpi. Please include a head-and-shoulders photo and a brief bio of author. **Articles cannot promote a product, service, or company.**

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## TOPIC IDEAS

### Project Narratives

Personal accounts of interesting land surveying/geomatics projects including the people, equipment and field procedures involved, together with tips for success that may benefit other surveyors.

### CLSA

Reports from committees and local chapters regarding Trigstar and the Boy Scout Merit Badge, joint activities with ACSM and NSPS, and service work (such as baselines and PLS examination review classes).

### Education

Reports from land surveying/geomatics curriculums in California including school location, program administrator, classes and degrees offered, status of enrollment, and job placement of graduates.

### Boundary Resolution and Mapping

Research opportunities available at public agencies, certifications and ALTA surveys, gaps and overlaps, easements, using survey narratives and notes on record maps, and applying PLSS methods.

### GPS and Geodetic Surveying

Using emerging technologies, fundamentals of datums for practical applications, defining geoids and ellipsoids, finding geodetic data on the web, interpreting published data sheets, and project planning.

### GIS

The surveyor's roles and responsibilities regarding GIS, the acquisition, use and dissemination of geographic information, and opportunities for networking with the GIS community.

### Photogrammetry and Remote Sensing

Principles, practical applications and limitations, descriptions of equipment and procedures, evaluating data quality, finding sources for existing coverage, and graphic examples of mapping products.

### Business Management

Strategies for diversifying a private practice, identifying nontraditional opportunities, suggestions for crafting contract language that satisfies clients, minimizes surprises, and limits liability.

## Article Submission Deadlines:


February 1st • May 1st  
August 1st • November 1st



## If You Missed the CLSA San Diego Convention Risk Management Panel

8. Encourage continuing professional education.
9. Encourage and support membership in professional associations.
10. Avoid making warranties or performance guarantees.
11. Include alternative dispute resolution requirements in your contracts.
12. Screen new clients.
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15. Keep clients informed with periodic status reports.
16. Avoid conflicts of interest or the appearance of impropriety.

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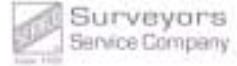


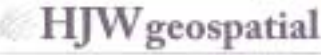

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# Here's Some Important Information About CLSA

The goal of the California Land Surveyors Association is to promote and enhance the profession of surveying, to promote the common good and welfare of its members, to promote and maintain the highest possible standards of professional ethics and practice, and to elevate the public's understanding of our profession. CLSA represents all Land Surveyors, whether they are employees or proprietors, whether in the public or private sector.

## Representation

**LOCAL:** Your local chapter represents you in local issues. Through your chapter representative to the State Board of Directors, the individual member can direct the course CLSA will take. **STATE:** The Surveyor is represented at the state level through an active legislative program, legislative advocate, and liaison with the State Board of Registration. **REGIONAL:** CLSA is an active member of the Western Federation of Professional Surveyors. This Federation is composed of associations throughout the western United States and addresses regional issues. **NATIONAL:** Through institutional affiliation with the National Society of Professional Surveyors and the American Congress on Surveying and Mapping, CLSA is represented at the national level.

## Educational Opportunities

CLSA presents annual conferences which provide technical and business programs, as well as exhibits of the latest in surveying and computing technology. Seminars and workshops are presented to assist in continuing education. CLSA publishes the California Surveyor magazine and the CLSA NEWS to keep the membership abreast of changing legislation, legal opinions, and other items which affect our profession.

## Business and Professional Services

CLSA provides a fully staffed central office which is available to answer questions or to provide up-to-date referrals concerning legislation, educational opportunities, job opportunities, or other issues concerning our membership. Professional liability insurance programs are available to members.

### JOIN CLSA TODAY!

- **CORPORATE MEMBER** \*\$159.00 + Entrance Fee. Shall have a valid CA Professional Land Surveyor or Photogrammetric license.
- **CE CORPORATE MEMBER** \*\$159.00 + Entrance Fee. Any California registered Civil Engineer who is authorized to practice land surveying pursuant to Article 3, Section 8731 of the PLS Act and must be actively practicing land surveying and show sufficient proof thereof. CE Corporate membership must be approved by the Board of Directors.
- **AFFILIATE MEMBER** \*\$79.50 + Entrance Fee. Any person who, in their profession or vocation, relies upon the fundamentals of land surveying.
- **ASSOCIATE MEMBER GRADE** \*\$79.50 + Entrance Fee. Any person who holds a valid certificate as a Land Surveyor-in-Training.
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