California Surveyor

Summer 2006 Issue #147

Passing the Gavel:

Armand A. Marois, PLS, Immediate Past President (left)
Robert J. Reese, PLS, 2006 CLSA President

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California Surveyor

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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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Passing the Gavel

By: Carl C. deBaca, PLS - Editor

From the Editor

Just flew in from Elko, boy are my arms tired…wait a minute, no one flies anywhere from Elko since the Sopwith Camel broke down. Speaking of Elko, did you know that toothpaste was invented here? Seriously, it was. After all, if had been invented anywhere else, they would have called it teethpaste. Not much to think about out here…brain shriveling up…arrrrgh!

April marks the 100 year anniversary of the San Francisco earthquake – April 18, 1906 to be exact. And speaking of anniversaries, 2006 marks the 40th anniversary of the California Land Surveyors Association. It's time to look back and thank those hearty souls who, in 1966 were forward thinking enough to establish this great organization. As times change and the issues that affect surveying change with them, CLSA has been right there, every step of the way, looking out for and sticking up for the profession.

An old saying goes, "May you live in interesting times..." and these are indeed interesting times. The issues we are facing now are of critical interest to each and every one of us, if we want to continue having this fine profession. Where are the future land surveyors hiding and how do find them? How do we get the pass rates for the LS exam up to a level that can beat attrition? How do we stop other professions/ semi-professions from encroaching into tasks that have been historically ours? What do we call ourselves and how do we present ourselves in the 21st century? How do we fit into the national and global definitions of surveying? These are all topics that CLSA is addressing in earnest. With your help we can continue to exert our influence and expertise in the boundary, geomatics, construction and geographic information fields and leave an exciting and worthwhile profession to those who follow in our footsteps.

Our services are in greater demand than a *Beginning Phonics* book at the White House, yet we see non-surveyors delivering these services more and more every year. But we've covered all this before, haven't we?

Speaking of interesting times - here's some food for thought from 1966:

- Curt Schilling, Cindy Crawford, John Daly, Sinead O'Connor, Mike Tyson and Halle Berry were born. Walt Disney died.
- LBJ was President. Troop levels in Viet Nam went from 190,000 to 250,000. France withdrew its troops from NATO.
- The Orioles won the World Series.
- Truman Capote wrote *In Cold Blood*.
- The Supreme Court decided Miranda Arizona creating your right to remain silent.
- Star Trek debuted.
- John Lennon declared that the Beatles were "…more popular than Jesus…" and later that year The Beatles played their last live concert at Candlestick Park.
- The unmanned Soviet space vehicle Luna 9 made the first controlled, rocket assisted landing on the moon.
- *King of the Road* by Roger Miller won the Grammy for Best Contemporary Rock and Roll Vocal Performance – Male. Tom Jones won the Grammy for Best New Artist.
- A sniper shooting from the bell tower at the University of Texas at Austin killed 13 people.
- Popular movies included *Born Free, Fantastic Voyage* and Blow Up. Elizabeth Taylor won the Oscar for Best Actress for *Who's Afraid of Virginia Woolf*.
- Medicare began.

Back to the topic of surveying. To get a feel for how far we surveyors have come, yet how close to home we have stayed since CLSA's inception, let's look at a few excerpts from the preface to the fifth edition of *Surveying - Moffit and Bouchard,* written in 1965 by Francis Moffit, a California Professor.

"Since the fourth edition of this book was published, new instrumentation has been developed to measure distances electronically."

"Chapter 10 has also been revised to include the latest classification for the accuracy of horizontal-control surveys, and to show triangulation computations performed by desk computers."

"…the engineer and scientist must rely more heavily than heretofore on the methods of statistics and the adjustment of observations by the principles of least squares."

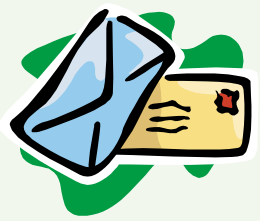
"Control surveys of any extent should be tied to the state plane coordinate systems in order to upgrade the surveys and eliminate much duplicated effort on the part of agencies and individuals responsible for these surveys."

"Measurements made with automatic devices to obtain earthwork data directly from stereoscopic models are discussed in Chapter 16."

"The chapter on stadia measurements has been expanded to include optical distance-measuring devices other than the transit and the telescopic alidade."

Year Zero – electronic distance measurement, least squares, desk computers on the one hand, triangulation and stadia on the other. Year Forty – GPS virtual networks, high definition surveying, GIS on the one hand and all that came before on the other. CLSA – 40 years and going strong!

This issue sees Jas Arnold educating us with respect to 'world' files which allow geo-referencing of digital images. Lee Hixon offers a persuasive argument for having more than one surveyor stamp a map if different surveyors were responsible for different aspects of the work. Dave Ryan reflects on last month's CLSA conference at the Silver Legacy in Reno. Hal Davis recalls the atmosphere in which the CLSA was created and Robert Reese, our president, gives his thoughts on where we are going this year. We also say goodbye to two stalwarts of our organization who passed away this year, Bill Young and Bud Uzes. They will be missed. ❖



Letters to the Editor

Dear California Surveyor Editor,

Early and often novice surveyors are impressed with the importance of NOT touching the tripod once the instrument is set-up. This faux pas is pictured repeatedly in the California Surveyor, Winter 2005-06 Issue #146: front cover (same picture pages 5, 31 and 34), drawing page 27, picture page 35 and the cartoon page 44.

I usually do not write letters to the editor but this edition featuring "Mapping the Course of Future Surveyors" seems to be the worst place to show such a "NO--NO".

Regards,
Tom Sekel, P.L.S.
Sacramento County, Municipal Services Agency
Dept. of County Engineering.
Development & Surveyor Services

Calif. Surveyor winter 06, Dr. Crossfield 4 year programs.

I agree with Dr. Crossfield that there is a shortage of Land Surveyor students, not just here but throughout the US. Many States are experiencing large reductions in LS exam applications where 4 year degrees are required for licensure.

One of the major problems with 4 year degree Surveyors is that they don't want to be Surveyors, they want to be project managers, department heads, owners, etc. They feel, and rightly so, that with a degree they don't need to get their hands dirty working in the field and a lot of firms fraudulenty sign off the field requirement so these graduates can get their licenses. 90% of learning to be a good surveyor requires lots of field time. Schools just don't have the time to cover most of the issues field surveyors must address daily.

While I sympathize with Dr. Crossfield, I think we need to "rethink" the one and two man field crews, go back to three man crews and start recruiting more "on the job" field trained Surveyors.

Walter T. Foster, PLS

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By: Robert J. Reese, PLS - President

President's Message

...take one

It is an honor and privilege to be this year's President of CLSA. I thank you all for your support and confidence. With the help of a very cohesive Board of Directors and all the CLSA members, and the expertise of the Central Office, I know we'll do great things this year.

Actually, we're already off to a great start. This year's 40th Anniversary Conference in Reno, Nevada, was a huge success: great attendance and accommodations at the Silver Legacy; many very valuable workshops and seminars; a record-breaking scholarship auction; the premier showing of CLSA's recruitment and outreach video, "Make Your Mark, Choose Your Path"; an anniversary reunion of many of CLSA's past presidents; outstanding entertainment at the luncheon...the superlatives just don't stop.

But what's next? Where is CLSA going and how do we get there? With the last few years of good economic conditions, our Education Foundation is flourishing, we're working well with many other professional and government groups, the numbing results of the LS exam are being addressed, and at work everybody is busy (probably busier than you can handle). It seems that things are good in Surveyland.

Perhaps. But there are some clouds on the horizon and they're building fast. Recruitment into our profession is almost as low as the exam pass rate. One need only look at the number of want ads for land surveyors (at all levels) to see that there aren't enough of us to go around. Other technical and paraprofessional groups are looking hard at the supply and demand situation for land surveyors, seeing an opportunity to provide services that the existing cadre of licensed land surveyors can't keep up with.

And the political environment is always a little treacherous. NCEES exerts constant pressure for all the states to embrace a national "standard" for engineering and surveying. NSPS is reconsidering our (US) place in the North American Free Trade Agreement (NAFTA) and reviewing the Mutual Recognition Document (MRD) that could describe our protocols with non-nationals looking for engineering and survey work in the US. Other geospatial groups (GIS, photogrammetry, remote sensing, cartography) are seeking licensure that will certainly overlap the scope and breadth of land surveying, as we know it here in California.

But the Chicken Little response to pressure is never very productive. There are things we can do. We can build bridges...and these bridges don't require a license to build.

Some of these bridges already have good foundations laid. CLSA has begun a sincere dialogue with BPELS, our board of registration, and others regarding what can be done about the poor exam pass rate. CLSA is developing an Exam Guide that will key candidates into the depth and breadth of knowledge needed to become a licensed land surveyor. But we need more people to even consider starting on the path to becoming a land surveyor. So we need to build a bridge to the profession.

It's a great profession that offers much to many. The bridge to students considering new careers (and to others considering career changes) has been started with our outreach and public awareness program. The CLSA video "Make Your Mark, Choose Your Path" is now complete and will be made available to just about everyone who is in a position to suggest careers to young, bright individuals. As well, by showing some of the many different directions that land surveying can take, we hope we can elevate our image in the mind of the public that land surveyors are not just road technicians, doing some kind of arcane engineering. Land surveying is, indeed, so much more.

To borrow a phrase, "build it and they will come." Sure, but if you build "it" in the middle of the night, quietly and in a place where no one goes, the only people that will come are those who stumble upon land surveying. So we need to spotlight our effort, to come out of the dark. As a professional organization, we need to bridge the gap to so many other groups: real estate professionals; construction organizations; title companies; cities, counties, special districts; engineers. We need to let them know we land surveyors are an available group with much to offer and that our voice is a significant one.

Our voice with the National Society of Professional Surveyors (NSPS) and the American Congress on Surveying and Mapping (ACSM) has to remain strong. We have started building bridges with these groups by active, constructive dialogue about California land surveyors' perspective on national – and international – matters. California has the largest number of licensed surveyors of any state! And we have the second highest number of land surveying society members, second only to Texas! If we orchestrate that voice, that is one damn big voice.

Our work with NCEES is continually evolving and changing. The trend toward standardization of state laws, definitions and procedures is, for the most part, a good thing, imparting uniformity, equity and mutual understanding. But land surveying has been, and is, parochial by nature. What is acceptable land surveying legislation and purview in New York may not be good in California. So our bridge with NCEES will be a well-traveled one.

I hope to see many bridges being built during the near and long term, capitalizing on the precedent good work of our organization, and leveraging the resources, intelligence and capabilities of those still to make their way through the land surveying profession. With all that we land surveyors have done in society, and with all that we have to offer, these bridges will be good for our local and planetary community. But after all these bridges are built, then what?

We must cross them. ❖

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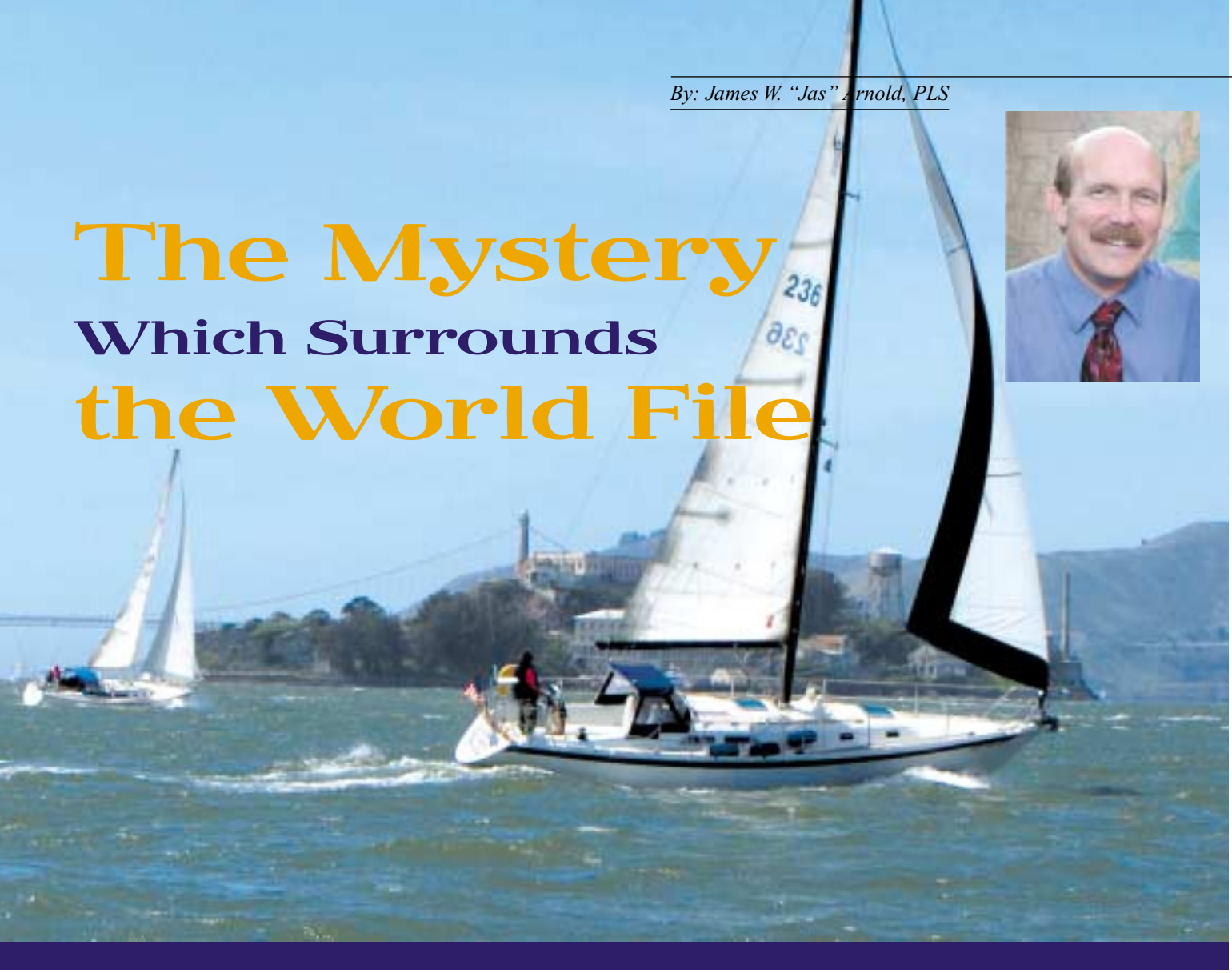

The Mystery Which Surrounds the World File

By: James W. "Jas" Arnold, PLS

Background

A world file is a simple text file which contains six numbers which are used to orient an image, usually a digital orthophoto, within a CAD or GIS system. This process is known as georeferencing. By changing the numbers within the world file, the image can be rotated, stretched, tweaked, flipped, and moved such that it appropriately fits a given coordinate system. Certain changes to these values can also result in completely meaningless yet entertaining manipulation of the image. Along this path toward the true meaning of a world file, we will touch on just a few of the many exciting areas dear to the hearts of all surveyors. These topics include imagery, coordinate transformations, trigonometry and a taste of least squares.

Digital Image

Let's start with the concept of a digital image. This is a file filled with rows and columns of picture elements known as pixels. Generally, these pixels are square and each of these squares has a unique color value. If it is a black-and-white image then the pixel has a grayscale value somewhere between 0 (black) and 255 (white) as shown in Figure 1. If the image is color then each pixel has three color values which also range between 0 and 255 for each pixel; a value for red, another for green, and a third value for blue. This trio of values is known as the RGB value. Whether an image is grayscale or color, it still needs to be oriented within the CAD or GIS system. This is where the world file comes into play. The image which we are positioning is most always a digital orthophoto which is a photograph that has been corrected to show features in their true orthographic position, just like a map.

Image Orientation; The World File

Let's start with the simplest application of a world file; one for a North-oriented image with square pixels. This file

Continued on next page

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will define how much ground each pixel will occupy (also known as the ground sample distance or GSD) and the location of the image. The first line of the world file gives the size of the pixel in the X direction. The second and third lines are zero for an unrotated image and the fourth is the size of the pixel in the Y direction. The fifth and sixth lines are the X and Y coordinates of the center of the upper left pixel. Figure 2 graphically shows this simple world file along with the orthophoto which it orients. This is the most common (and most practical) version of a world file; square pixel and no rotation. For some earlier versions of CAD and GIS systems, this is all they could handle.

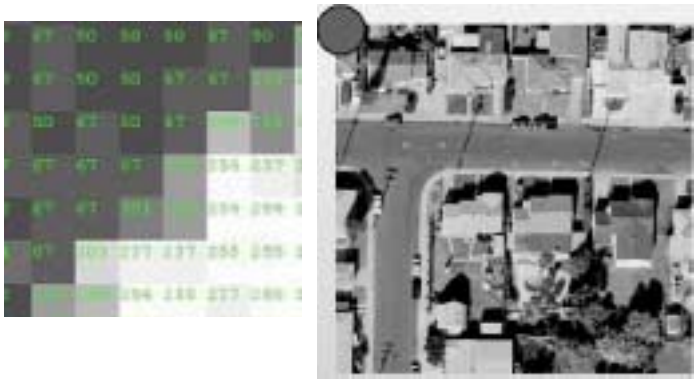

Figure 1: Digital Image

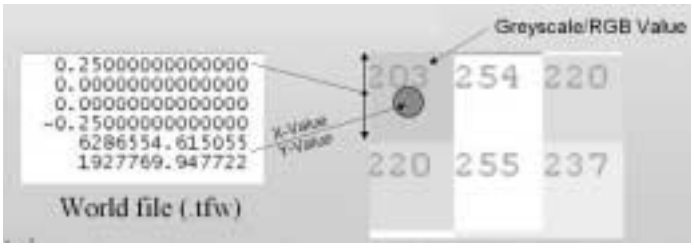

Figure 2: Basic World File with Orthophoto (right)

Image Coordinate System

Surveyors and most mathematicians perceive a Cartesian coordinate system where the Y value increases going up (North) and the X value increases going right (East). For some reason the image people are different. Images are viewed as a system of rows and columns. The column is analogous to 'x' and the row to 'y'. The origin of this system is the upper left corner of the image. The center of the pixel which occupies this corner has a coordinate value of 0,0. The x coordinate increases to the right and the y coordinate increases (becomes more negative) going down For the remainder of this discussion, the image coordinates will be in terms of lower case x and y.

Let's take a moment to establish the relationship between the ground and image coordinate systems. The

first system is based on real-world (ground) coordinates. The ground coordinates for this study are those of the CAD system. The second system is that of the image which indeed is nothing more than another coordinate system. The primary difference between these two systems is the units which is really only a matter of scale. The ground-based system units are usually meters or feet while the image system is in terms of pixels. Our initial study of these coordinate systems will be of an assumed ground coordinate system and a four row, six column image coordinate system as shown in Figure 3. The squares in this figure are 5 unit pixels. Think of this 4 x 6 rectangle as an image. As far as world files are concerned, image size is immaterial. All we care about is the upper left pixel. The rest of the image just follows. The world file for this unrotated, 5 unit pixel image which has the center of the upper left pixel at the ground coordinate position (X,Y) of 13138.3959, 31313.3630 would be:

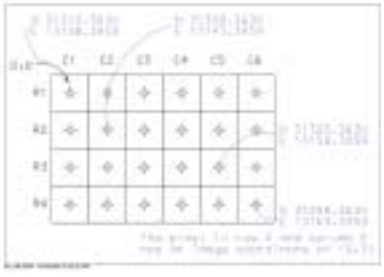

Image coordinate System

Continued on next page

Continued from previous page

5.0000
0.0000
0.0000
- 5.0000
13138.3959
31313.3630

The discussion found in the two paragraphs above is all that you need to know for an unrotated image with square pixels. Lines 2 and 3 of the world file will always be zero if the image is not rotated. The most common way to orient an orthophoto is in a North-oriented, non-rotated position with square pixels. There are situations however where a rotated orthophoto is desired to efficiently cover a project area. Even if rotated, a newly created ortho will most always have square pixels. The sample shown in Figure 4. is for a rotated image with a pixel size of 5.0 units. A rotation angle of 36.8699° was selected to force a 5.0 unit pixel (GSD) to have dX and dY components of 4.0 and 3.0 respectively as shown in Figure 5. The world file for this rotated image would be

Figure 4: Rotaded Image Coordinate System

4.0000
3.0000
3.0000
-4.0000
13138.3959
31313.3630

Figure 4: Rotaded Image Coordinate System

Let's take a closer look at the world file of this rotated "image". The actual pixel size (5) is nowhere to be seen yet the dX and dY values (4.0 and 3.0) are. In surveyese these can be thought of as the departure and latitude for a side of the pixel. Also note that these values occur twice in the world file. Hmm, the plot thickens...

The True Elements of a World File

I have labeled this section of the paper "the true elements of a world file". I say this because many people do not understand what the first four lines of the world file actually do. Many believe lines 2 and 3 convey the rotation of the image. Somebody please tell me how you get 36.8699° out of 3.0 and 3.0. Below is an except from (ESRI 2005) as the answer to a question regarding the meaning of a world file.

> The world file is an ASCII text file associated with an image and contains the following lines:
>
> Line 1: x-dimension of a pixel in map units
>
> Line 2: rotation parameter
>
> Line 3: rotation parameter
>
> Line 4: NEGATIVE of y-dimension of a pixel in map units
>
> Line 5: x-coordinate of center of upper left pixel
>
> Line 6: y-coordinate of center of upper left pixel

Lines 1, 5, and 6 are correct. Line 4 is kinda correct but lines 2 and 3 are wrong.

Wait a minute. The arctangent of line 2 divided by line 1 (3.0/4.0) is 36.8699°. I think we're on to something.

The six lines of a world file are the parameters of a 2D affine coordinate transformation. The affine designation means that the scale can be different in the x and y direction. This type of transformation also permits the nonorthogonality (nonperpendicularity) of the axis system.

Two-Dimensional Affine Coordinate Transformation Primer

The two-dimensional affine coordinate transformation is the meat and potatoes behind the world file. This transformation is also known as the six-parameter transformation. Pixel elongation occurs when images are reprojected into a different coordinate system. This situation equates to scale differences in the x and y direction. Nonorthogonality between the x and y axes is also allowed for yet impractical unless the pixel is a parallelogram (like I said, impractical). The mathematical model for this affine transformation (ASPRS 2004) is the following system of observation equations:

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By: R. Lee Hixson, PLS (CA, NV, OR, UT, ID, WY)

The Need for Dual-Stamped Maps

Have you ever worked on a project where the field work was handled by one surveyor, and all the office work was handled by another surveyor? Of course you have. It happens all the time. From small firms to large firms this is a typical scenario, and yet the maps that get recorded in California allow for only one surveyor to stamp and sign them, despite the fact that multiple surveyors have exercised responsible control over the work.

Why do we do this?

I suppose that this practice has historical roots, dating back to past centuries where most licensed surveyors worked either for themselves, or with small firms, and literally performed all the work for the project from start to finish. They got the contract, did the research, ran the field crew, did the calculations, analyzed all the data and either did the drafting themselves, or closely supervised it. Thus, it only made sense that they would take full responsibility for the entire product and, when the map arrived at the Recorder's Office, it would only bear one stamp and signature.

But this is clearly not the case anymore. I have been surveying in California since the late 1970s and the trend has obviously been in the direction of multiple responsibilities for the mapping that is being done. There are variations, of course, but isn't it very common that you work for a firm where the field work is separated from the office work? Of course it is. As project surveyors or project managers we try our best to visit the site to be familiar with the field conditions, inspect some of the land net monuments in the area, watch the crew for a while, and carefully examine their field notes, but the reality is that 99% of our billable time is spent in the office.

The result is that we are forced into a position of trusting that the field work is being done to our satisfaction. If we have worked with the same firm for many years, and if the field survey staff hasn't had too much turnover, then we have a greater chance for developing a higher level of confidence in the field work being done...that the crew members are being diligent and professional, and closely following our guidance in each phase of the project.

But no matter what the circumstances of the firm—the longevity of the working relationships between the field and office personnel—the truth is that, to a great degree, we do not follow the legislated maxim of being "in full responsible charge" of the field work being done. While we may be taking full responsibility for the field work, if we are not actually out their doing the work ourselves we are merely trusting that it is being done the way we would do it ourselves.

I have worked for small firms where the office LS was heavily involved in the field work. He or she would be the only one to study the previously recorded maps in the area and do the pre-calculations for use by the crew in locating the land net monuments. They would also prepare the crew package and give a detailed briefing on what was to be done that day, perhaps being in phone contact with the party chief during the day and getting personally debriefed when the work was completed...even downloading and checking over the field data.

But I have also worked for larger firms where there was a greater disconnect between the office and the field. It is not uncommon for one cadd tech to do the precalculations and another tech take care of the transfer of data from office to field, and field back to office. It is also possible for yet a different staff member, who is skilled in least squares adjustment, to adjust and balance the data before handing it over to the project surveyor. Many specialized staff members might play key roles in the office.

Not that such a division of authority is a bad thing. Of course not. Many firms are performing high quality, professional surveying with numerous staff being involved at the various stages of the mapping process.

The point is, to one degree or another, most firms have a division of labor where there are multiple people involved in a particular project. Any of the common types of survey projects can be divided up into phases, allowing for different people with different specialties to participate in the eventual final product. And the biggest differentiation is between the field and the office. There is some degree of divided authority between the different office tasks, but it is between the office and field work where we see the largest "gap" in the chain of responsibility.

But that gap need not be a problem if everyone involved is doing their work professionally and the good communication and proper quality control is being implemented. There are firms where some of the party chiefs are licensed surveyors. Here we have, not just a physical separation between the office and field, but a situation where there is a licensed person on each end of the work.

Continued on next page

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Let's take it one step further. How many of you have been involved in(or heard about) cases where one firm subcontracted the field work to a second firm? A licensed person in Firm A does the research and the pre-calcs, then has a licensed person in Firm B oversee their own crew in performing all the field work. Firm A takes the field data, processes it and eventually completes a boundary resolution. Firm B is then given the coordinates for the monuments that need to be set, and they proceed to set them.

Is there anything inherently wrong with such a division of the labor? As long as the two firms have licensed surveyors taking responsibility for their separate phases of the work, of course not. So then why not allow them to both stamp and sign the map?

In the first case, where one firm has an office LS as well as a party chief who is an LS, it may be more discretionary as to whether one or both of them stamp the map. But in the second case doesn't it seem practical and even desirable that both of the surveyors should have their stamps appear on the final mapping product?

Let's face the reality of modern surveying. With the tremendous changes that have taken place in the past 15 years in the technology of field data collection, there has been an ever-increasing tendency for the surveying profession to further specialize. For a long time we (and our state laws) have sidestepped the issue of multiple sub-licenses within the profession. For unexplained reasons we have not gone the way of engineering and subdivided the licensing process to recognize specialties (civil, structural, geologic, etc.) despite the realization that, as our profession evolves there is a compelling need to do just that. Some day we may wake up and change our laws to provide for a "General Licensed Surveyor" designation, along with sub-licenses for boundary analysis, water boundaries, photogrammetry, construction staking and public land survey work.

But while we wait for this eventual subspecialzation to be recognized, can't we at least acknowledge the reality that, very often, the office and field work is supervised by two different people? Why can't we change the Subdivision Map Act and Land Surveyor's Act to allow for two people to stamp a topography map or any of our maps that get recorded? The Surveyor's Statement could be altered slightly to reflect the different responsibilities. For a Record of Survey these could be the two versions of the Surveyor's Statement:

> This map correctly represents a field survey made by me or under my direction in conformance with the requirements of the Professional Land Surveyors' Act at the request of
>
> _____ in _____, 20 ___.
>
> This map correctly represents the boundary resolution portion of a survey made by me or under my direction in conformance with the requirements of the Professional Land Surveyors' Act at the request of
>
> _____ in _____, 20 ___.

Each licensed surveyor would stamp the appropriate statement. Similar alterations could be made to the statements shown on Parcel Maps, Tract Maps and topographic survey maps. The Land Surveyor's Act could contain a new paragraph that would explain the allowed division of authority; the Subdivision Map Act could also be revised toward the same end.

There are two main benefits to such a change: 1) that State Law would finally reflect the way that work is actually being performed every day around the state, and that, 2) each surveyor involved with a project would be able to take credit—and responsibility—for that portion of the work that they were in charge of. There is nothing intrinsically wrong with moving in this direction and it only seems right that our laws bear a closer resemblance to how the profession actually operates.

I have been told that, in Germany, the party chief, the drafter and the office surveyor in charge all stamp and sign the map. Doesn't it make sense? Shouldn't we allow for, if nothing else, the possibility that more than one person was in responsible charge of a survey? Why should we continue to pretend that only one licensed person was involved with a project, if in fact there were two? ❖

Continued from page 14

$$Ax + By + C = X + VX$$
$$Dx + Ey + F = Y + VY \quad (1)$$

One equation is written for each coordinate of each point thus three points yield six equations. The lower case x's and y's in the above equations are the image coordinates. The upper case X's and Y's are the ground coordinates. The letters A through F are the unknown transformation parameters which we will see are the six lines of a world file. A thorough background discussion surrounding the wheres and whys of the coefficients in Eq. (1) can be found in (Wolf 2000) and (Wolf 1997). These discussions relate a bunch of sines, cosines, and tangents to the ground coordinate and image coordinate systems. A beauty of least squares is seen in the simplicity of the equations above. To solve the six unknowns in these equations uniquely (without redundancy), three points whose positions are known in both coordinate systems are required. If more than three points are known (now we have redundancy), a least squares solution can be obtained. I used four points for all of the solutions performed herein to trap any potential fat fingering which indeed did occur. With only three points, the same least squares matrix solution method can still be used. The four points used for this sample transformation stem from the tweaking exercise that follows. These points are shown graphically in figure 6. These points are:

FEATURE	IMAGE COORD (PIXCEL)		GROUND COORD (FEET)	
	x	y	X	Y
UL CORNER	0	0	11329.419	28800.309
SAIL TEXT	71	152	11424.717	28746.611
WAVE	56	669	11569.317	28538.311
WINDOW	675	492	11949.518	28671.010

Table 1. Tweaked Image Data Set

The matrix representation of Eq.(1) is:

Ax + By + C = X + VX
Dx + Ey + F = Y + VY

	A	B	C	D	E	F			
UL_x	0	0	1	0	0	0	A	11329.419	VX_1
UL_y	0	0	0	0	0	1	B	28800.309	VY_1
sail_x	71	152	1	0	0	0	C	11424.717	VX_2
sail_y	0	0	0	71	152	1	D	28746.611	VY_2
Wave_x	56	669	1	0	0	0	E	11569.317	VX_3
Wave_y	0	0	0	56	669	1	F	28538.311	VY_3
win_x	675	492	1	0	0	0		11949.518	VX_4
win_y	0	0	0	675	492	1		28671.010	VY_4
	Matrix →			A			X	L	V

Table 2. Observation Equation Matrices

$$A X = L + V \quad (2)$$

A is the matrix of coefficients populated by the image coordinates, X is the matrix of unknowns which when solved is the six elements of the world file, L is the matrix of ground coordinates and V is the matrix of residuals. If only three points for the solution, the V matrix will be null (a vector of zeros). This matrix of residuals was also null in this example because the measurements were forced to be "perfect" in the absence of fat fingers. The next step in a least squares solution is to create what are known as normal equations:

Continued on next page

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$$AT A X = AT L \quad (3)$$

The least squares solution of these normal equations is:

$$X = (AT A)^{-1} AT L \quad (4)$$

A	00000.700
B	0.300
C	11329.419
D	0.100
E	-0.400
F	28800.309

Table 3. X Matrix

Steps Toward Controlled Image Morphing

Within the image coordinate system (Figures 3 and 4) the edges of each pixel are parallel to the axis. If the axes of the image coordinate system are nonorthogonal, then the pixel must be a parallelogram. I have never produced nor received an othophoto with pixels as parallelograms yet it is possible. Pixels created during the orthophoto generation process are initially square. A pixel may morph from a square to a rectangle due to reprojection of an image from one coordinate system to another such as between State Plane zones. The easiest way to morph pixels is by altering the first four lines of a world file. I have done just that in order to tweak an image and then perform a 2D affine coordinate transformation in order to repeat the changes made to the world file. These are the steps which I followed during this bizarre undoing and redoing of a world file.

1) Determine the image coordinates of the pixel centers of four distinct features (a minimum of three are required). The unit of measurement is the pixel and pixel (0,0) is in the upper left corner.

2) Create a world file to bring the image into a CAD system. The familiar 3-4-5 world file was selected. A CAD and GIS system standard is the base name of both the tiff file (.tif) and the world file (.tfw) must be the same.

3) Bring the image into a CAD system then go to each of the four distinct features selected in step 1 and record the ground coordinates. I used a very precise pixel frame with a center point to obtain a ground value in the CAD file to within 0.001 ft.

4) Perform a 2D affine coordinate transformation as discussed previously. Some handy educational software to perform this transformation can be found at: http://surveying.wb.psu.edu/psu-surv/free.htm. I used an Excel spreadsheet. The six unknowns that this transformation solves for are the six lines of the world file.

5) Slightly modify the world file such that the image is tweaked. The modifications I made were to lines one and two. The modifications are shown in table 4.

6) Create a new world file with the tweaked values. This is step 2 above.

7) Repeat steps 3 and 4

Original		Tweaked
0.4	A	0.7
0.3	D	0.1
0.3	B	0.3
-0.4	E	-0.4
11329.419	C	11329.419
28800.309	F	28800.309

Table 4. Tweaked World File

Figure 6: Tweaked Sail Image

Least Squares (LS) value D is the latitude of the top of the pixel. World file line 3 (LS value B) is the departure of the side of the pixel and world file line 4 (LS value E) is the latitude of the side of the pixel. This value is negative because it is going down. Remember the italicized down on page one? As discussed previously it is not a practical scenario to have a pixel occur as a parallelogram. This could be the case however if the true ground coordinates of distinct ground features which appeared on an unrectified aerial photo were used to rubber-sheet the photo. The image coordinates could be determined for these features. Step four as outlined previously could be used to come up with a world file which would tweak this image the best fit the ground. This would be far from a true orthophoto however it would produce a photograph that would more closely fit the ground conditions.

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Governor Schwarzenegger Appoints CLSA Past President, Patrick Tami

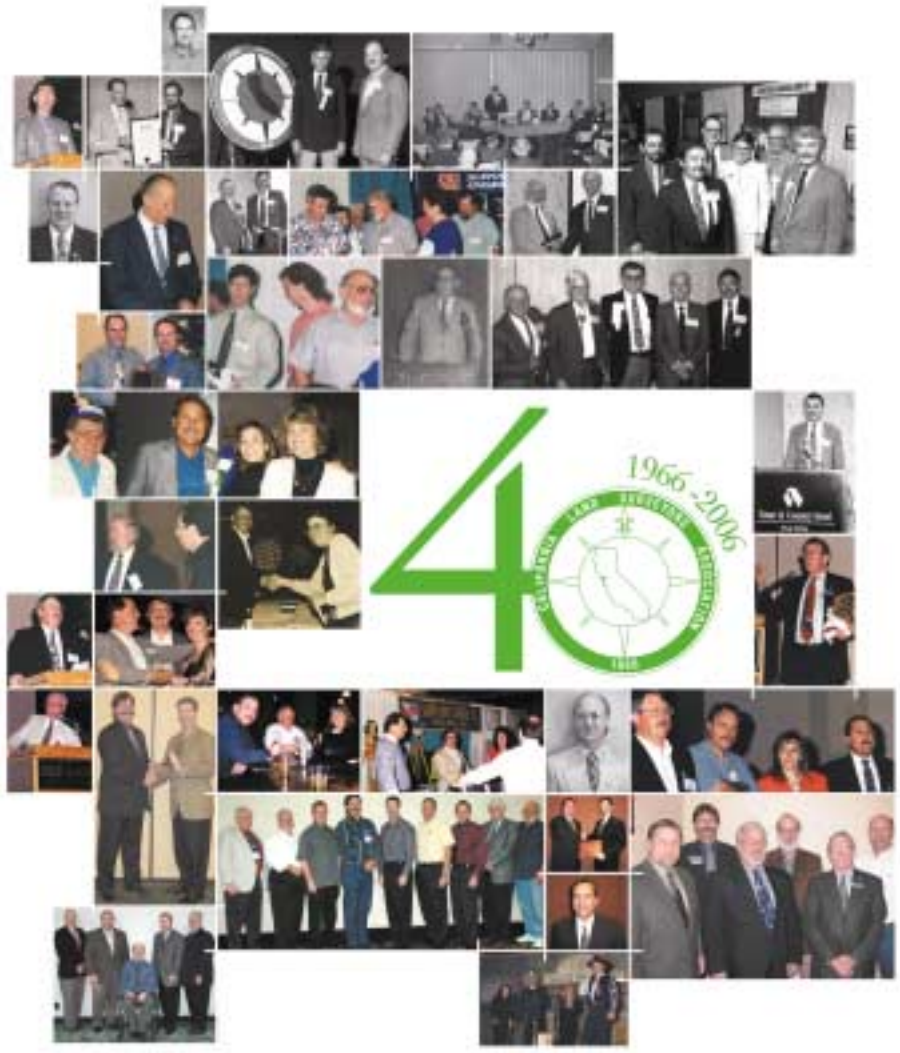
Governor Arnold Schwarzenegger has appointed Patrick Tami, P.L.S., to the California Board for Professional Engineers and Land Surveyors (BPELS). Pat has served as the CLSA President in 2001, member of the Board of Directors from 1992 until 2002, and chaired several committees since becoming a member in 1992.

Pat has also been active as a member of the Examinations for Professional Surveyors Committee, National Council of Examiners for Engineering and Surveying (NCEES), President of the Bay Counties Association of Engineers and Land Surveyors, Chairman of the East Bay Municipal Engineers and Chairman of the Diablo Valley College GIS/GPS advisory committee. He has served the BPELS previously as a grader for the Professional Land Surveyor Examination and as a member of the Board's Technical Advisory Committee.

By: Harold B. Davis, PLS

A HISTORY OF CLSA

Hal Davis reflects on the beginnings of CLSA



Prior to 1966, the only surveyor's organizations in California were the northern and southern sections of ACSM, both of which were primarily composed of public sector employees, licensed and unlicensed engineers and photogrammetrists.

In 1966 the California Council of Civil Engineers and Land Surveyors proposed a bill affecting the Land Surveyors license. This proposal, called "Plan A", would have eliminated the Land Surveyors license and grandfathered all existing licensees as Civil Engineers.

In response to this proposal a number of land surveyors in Northern California from both the private and public sectors met at the Napa airport to discuss the problem and decided subsequently to form the California Land Surveyors Association. In the early years of the association the main thrust was legislation against "Plan A" together with improvements to the Land Surveyors Act and the Subdivision Map Act. The ultimate solution was Senate Bill 2, which eliminated the Civil Engineer's exemption, but gave post-1982 Civil Engineer authority to practice "Engineering Surveying".

For the first few years, CLSA membership consisted of a "bunch of Northern California radicals" with some members south of the Tejon Pass. Many local chapters were formed, primarily in the north, with one southern group, the Southern Counties Chapter. This chapter never really became effective, as the Southern California Section of the ACSM remained the major voice of the land surveyor in the south. During the CLSA conference held on the Queen Mary in Long Beach Harbor, the CLSA Board and the SCSACSM Board held a joint meeting which reconciled most of the differences. Since 1966 there has been major growth in the membership and effectiveness of CLSA.

When CLSA first entered the legislative arena it was as rank amateurs. Now of course, we are recognized as the voice of the land surveying profession in California. Membership is now in excess of 2100 and the association's Legislative Advocate receives many queries from the state legislature. The annual conferences are well attended and highly successful.

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Origins of the California Land Surveyors Association

Editor's note:

The following is excerpted from a presentation to Fresno State Students by then-President Armand Marois in February 2005. who in turn used an article written in 1986 by Orlean Koehle for the 20th anniversary of CLSA as his source material.

CLSA CAN TRACE ITS ROOTS BACK TO TWO SEPARATE ORGANIZATIONS; A TRI-COUNTY GROUP CALLED "SONOMA, LAKE, AND MENDOCINO COUNTIES ENGINEERS AND LAND SURVEYORS', AND A SACRAMENTO GROUP CALLED, "CALIFORNIA ASSOCIATION OF LICENSED SURVEYORS."

THE SONOMA, LAKE AND MENDOCINO GROUP WERE THE ONE WHO INITIATED THE NEED FOR A STATEWIDE ORGANIZATION. THE GROUP HAD BECOME INACTIVE IN 1965, WHEN BOB CURTIS, PAST PRESIDENT OF CLSA, AND DICK STEPHEN BECAME CONCERNED "ABOUT THE MESS THAT THE PROFESSION HAD GOTTEN INTO".

SO, THEY ARRANGED A MEETING OF THE OLD TRI-COUNTY GROUP TO SEE IF THERE WAS ANY INTEREST IN FORMING A STATEWIDE ORGANIZATION. A MEETING WAS HELD AND THE CALIFORNIA LICENSED LAND SURVEYORS ASSOCIATION (CLLSA) WAS FORMED.

DICK HOGAN WAS ELECTED FIRST PRESIDENT AND A STEERING COMMITTEE WAS CREATED TO DRAW UP A CONSTITUTION AND BY-LAWS.

BY CONTACTING OTHER STATE LAND SURVEYOR ORGANIZATIONS TO SEE HOW THEY BECAME ORGANIZED, UTILIZING THE ILLINOIS STATE SURVEYORS ASSOCIATION'S MATERIALS AS THE FRAME WORK, THE COMMITTEE CAME UP WITH SEVERAL RECOMMENDATIONS FOR FORMING A BOARD OF DIRECTORS, DEVELOPMENT OF VARIOUS COMMITTEES, ESTABLISHMENT OF FEES AND DUES, AND TYPES OF MEMBERSHIPS, AND SCHEDULES OF MEETINGS.

THE PRESIDENT OF THE TRI-COUNTY GROUP CONTACTED THE SACRAMENTO GROUP INVITING THEM TO DISCUSS THE POSSIBILITY OF MERGING. DICK HOGAN THEN CONTACTED GENE FOSTER OF THE SACRAMENTO GROUP.

TO INVITE THE CALIFORNIA ASSOCIATION OF LICENSED SURVEYORS TO MEET AT THE HALFWAY POINT TO DISCUSS THE POSSIBILITY OF MERGING. ALL THE PARTIES AGREED TO MEET AT JONESY'S STEAK HOUSE AT THE NAPA AIRPORT ON JUNE 3, 1966. THE MEETING WAS HELD AND SINCE THE SACRAMENTO GROUP WAS A LOOSELY FOUNDED ASSOCIATION OF GOVERNMENT EMPLOYEES WITH THE SAME CONCERNS AS THE NEWLY FORMED (CLSA), THEY AGREED TO JOIN RANKS, AND, OVERNIGHT MEMBERSHIP DOUBLED FROM 15 TO 30 MEMBERS.

BY MID-1970'S, SOUTHERN CALIFORNIA SURVEYORS WERE GETTING INVOLVED TO HELP MAKE CLSA A TRUE STATEWIDE ORGANIZATION.

SOME OF THE FIRST PROBLEMS CONFRONTING CALIFORNIA SURVEYING WAS WORK BEING PERFORMED BY UNLICENSED INDIVIDUALS; SUB PROFESSIONAL WORK BEING PERFORMED, LACK OF EDUCATIONAL OPPORTUNITIES, AND HARMFUL LEGISLATION BEING PROPOSED.

ONE EXAMPLE WAS THE OBJECTIVE BY THE AMERICAN SOCIETY OF CIVIL ENGINEERS TO HAVE ALL REGISTRATION BOARDS REQUIRE THAT ANYONE WHO WISHED TO PRACTICE LAND SURVEYING SHOULD FIRST OBTAIN A PROFESSIONAL ENGINEERS' LICENSE. CLSA FELT THEN, AS IT DOES NOW, THAT PEOPLE WHO PRACTICE LAND SURVEYING SHOULD BE EDUCATED, EXPERIENCED, TESTED, AND LICENSED.

THE BEGINNING OBJECTIVES OF CLSA ARE NOT MUCH DIFFERENT THAN THEY ARE TODAY. IN A LETTER BOB CURTIS WROTE IN APRIL OF 1967, STATES;

OBJECTIVE 1

TO GET THE ACTIVE PARTICIPATION OF ALL CALIFORNIA LAND SURVEYORS INVOLVED IN CLSA—TO GAIN STRENGTH AND UNITY IN THEIR ASSOCIATION.

OBJECTIVE 2

TO BE ABLE TO ADVANCE THEIR CAREER THROUGH SUPPORTING PROPER LEGISLATION, MONITORING ANY PROPOSED LEGISLATION THAT COULD BE STRONG ENOUGH TO COMBAT IT.

OBJECTIVE 3

TO DEMAND A LAND SURVEYORS' RIGHT TO BETTER EDUCATIONAL FACILITIES AND THE RESOURCES TO USE THEM.

OBJECTIVE 4

TO BE REGARDED AND RESPECTED AS A PROFESSION BY REALIZING THAT "HIGH STANDARDS REQUIRE HIGH PERFORMANCES"

LATER ON IN 1986, BOB CURTIS ALSO ADDED THAT THE PRIMARY OBJECTIVES OF CLSA SHOULD BE:

TO BE THE VOICE OF ALL LAND SURVEYORS IN CALIFORNIA, THEIR MAIN SOURCE OF INFORMATION AND TO PRESERVE THE PROFESSION.

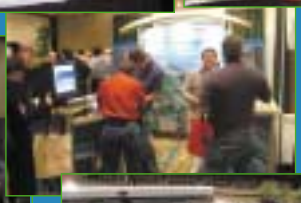
BOB ALSO ADDED THAT WHAT THE ALTERNATIVE COULD BE BY NOT GETTING INVOLVED:

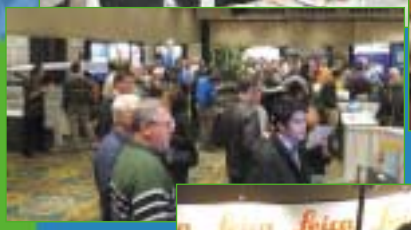
"WE COULD, THROUGH BLISSFUL IGNORANCE, LIKE THE KIKI BIRD, BECOME EXTINCT." ❖

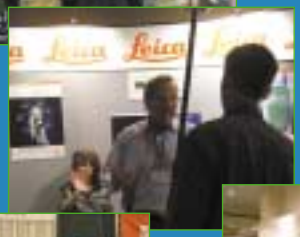
CLSA

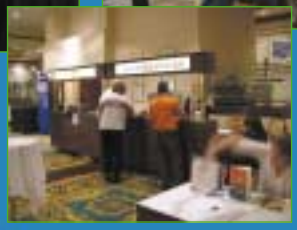
CALIFORNIA LAND SURVEYORS ASSOCIATION

REFLECTING ON THE PAST – MAPPING THE FUTURE









1966 - 2006

CALIFORNIA LAND SURVEYORS ASSOCIATION

1966

Reno Conference 2006 *Highlights*

Conference 2006 *Afterthoughts*

There's a guy in the row behind me doing a running editorial on every comment the speaker makes. I get that feeling I'm sitting in a movie theatre. It's hard to tell from the tone of his voice whether he agrees or disagrees, but there is a discernible tone of sarcasm and disrespect. I'm wondering if his companion is growing as weary of his commentary as I am. I wait, thinking, "OK, I'll resist the temptation to shoot him a glare, he'll cool it any minute". Or do I ping him with my popcorn? Never mind, I'm not in the theatre, I don't have any popcorn. He does eventually tone it down, so I can get my attention back to the excellent presentation being made.

Fortunately this incident was an anomaly (an outlier, if you will). Every presentation, I repeat, EVERY presentation I attended at the CLSA conference recently held in Reno, Nevada kept me in rapt attention. I come to these conferences with high expectations, knowing there are dynamic and expert presenters out there, hoping the organizers managed to land them. They did. I can't remember the last time I walked away from the conference feeling that not a single session was a waste of time. Usually there's one; the speaker who compels you to catch up on a little snooze, or convinces you it's time to wander the Exhibiters' Hall and stuff the Cartwright bag with some more freebies.

Not only did the organizers of this conference get it right with the presenters and the session topics, they seemed to get it right with everything, from Monday's luncheon speaker (Joe Malarkey, who was one funny guy), to the scholarship auction (which raised almost $20,000!) , to the exhibit hall, the afternoon cookies, and the special release of Bud Uze's book.

Steve Parrish-CSI (Corner Site Investigation)

No matter where you work, whether it's the chaparral of southern California, the high deserts of northeastern California, or the redwood forests of northwestern California, Steve's approach to research in the PLSS system and finding those elusive corners is something all of us can glean something from. I was astounded at the number of scenarios he presented that revealed "new secrets" that will surely come in use. Whether you're in "pits and mounds" country, big-tree country, or the big city, it doesn't matter. Steve imparted inspiration, experience, and knowledge. That's what I came for!

David Paul Johnson-The Past, Present and Future of the "One-Man Survey crew".

David is one of the those speakers who gets you sitting on the edge of your seat immediately. From then on, he's got you, because you don't want to miss what may come next. He's a highly entertaining speaker. He's also very concerned about surveying. Very concerned. Although I can't put my finger on exactly what concerns him. I was left with one very important concept he imparted upon us. That of the robotic, one-man crew. What happens with the mentorship aspect of surveying? With our profession lacking incoming surveyors, that gives us something to ponder.

Michael Durkee- Subdivision Map Act

Of the many Map Act seminars I've attended throughout the years, this was the first time I've attended one of Michael's. Without a doubt, he's the most dynamic, articulate, and exciting Map Act presenters I've ever seen. That's right, I used the term "exciting" in the same sentence as "Map Act". OK, so maybe I don't get out enough. For a subject many of us learn because we have to, Michael showed us this is a topic worthy of our attention. For me, it's difficult to yearn for Map Act knowledge in the manner one does for boundary doctrines, for instance. Like all the other sessions, we just ran out of time. What is it with you people, still sitting in your seats not wanting to leave? Where were all the seat shufflers in the last twenty minutes? Not at this one.

Jim Pilarski-Legal Descriptions

Are you like me, in that you show up to certain classes thinking, OK, what new ground can they possibly cover here? I mean, don't I already know ALL there is to know about this stuff? In fact, why didn't they call me to put this thing on? Then Jim comes along. I don't know if Jim is from back east, or maybe he's Italian (hmmm… Pilarski...) but I love the style of no-nonsense speaker that Jim is. No BS there. My descriptions can always use some improvement. Next time I write one, I'll have some new tools to incorporate.

Howard Brunner and Ray Mathe-The Land Surveyor's Act

Howard and Ray had to scramble to cover for a couple of others from BPELS who were to take part in this session, but were unable to attend. I'm not sure how Howard has kept his sanity over twelve years of being Land Surveyor consultant to BPELS, but he seems to have come out unscathed, and in my opinion has raised the bar during his tenure. During this presentation-discussion, an audience member raised a personal Record of Survey issue he is having with the Orange County Surveyor's office. Orange County Surveyor Ray Mathe handled the matter with professional composure and humor. Audience member-bad call. Ray Mathe-class act.

I was unable to get to the other concurrently occurring sessions, but the general feedback in the halls was good.

Over breakfast one morning in one of the many restaurants the hotel offers, several of us were engaged in small talk. Having just been introduced to a surveyor from the other end of the state, an occasion arose to briefly share opposing views of a political nature. We then settled in for breakfast, some survey talk and the ritualistic exchange of business cards. When the time came to cover our tickets, this surveyor, who shall remain nameless (Paul Cook) picked up my breakfast. This type of thing happens more than I can count at these gatherings. The common bonds we share as surveyors and the feelings of goodwill tend to trump other "smaller" issues, like politics. Paul has my number. I have his. We're only a phone call or e-mail away from that bit of information the other guy may be in need of sometime. I hope to get an opportunity to pick up Paul's meal next time, or at least buy him a cold one (iced tea, of course…).

Dave Ryan has been surveying since 1978, and currently resides in Arcata, Ca. where he works for the Humboldt County Surveyor's Office. ❖

Continued from page 19

The Mystery Which Surrounds the World File

Determining Image Parameters From the World File

The pixel size and dimensions and the image position and orientation can be derived from the world file. The reader can apply basics of trigonometry to the values shown in figures 5 and 7 to solve these. These relationships are:

For the case of a simple image with square pixels…
Image rotation (CCW from East) = arctan(line2 / line1)
Image rotation (CW from North) = arctan(line1 / line2)

Pixel dimension = $[(\text{line1})^2 + (\text{line2})^2]^{1/2}$

For a skewed / affine image…

Pixel dimension
Top = $[(\text{line1})^2 + (\text{line2})^2]^{1/2}$
Side= $[(\text{line3})^2 + (\text{line4})^2]^{1/2}$

Pixel Rotation (azimuth)
Top = arctan(line1 / line2)
Side = arctan(line3 / line4)

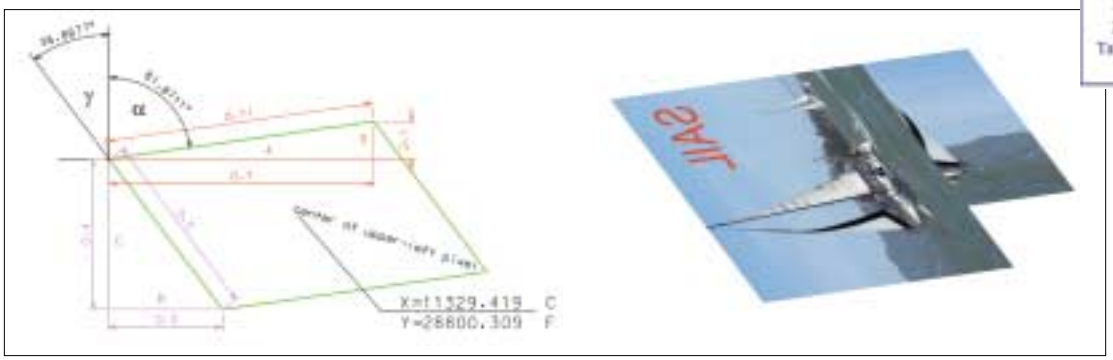


Figure 7: Tweaked Pixel

Let's make changes to the world file and observe what it does to the image as it is brought into the CAD file. Now that you are world file-fluent, you can probably predict what is going to happen. By merely changing the sign of line 4 (the latitude of the side of the pixel), the image hinges on the top edge and comes in inverted. The same thing happens if we change the sign of line 3 but along the side edge. A very interesting thing to do is to swap the easting for northings in the image coordinates which were equated to ground coordinates. I did this with the coordinates used to tweak Julian's sailboat. What we see is what happens when you provide coordinates to the photogrammetrist and don't tell him they are in Pt#, Northing, Easting, Elev format. You see, surveyors are into the northing-easting-elevation thing and photogrammetrists are into the X-Y-Z thing. Try this: hold the palm of your left hand in front of you. Rotate it about the little finger axis so your thumb is pointing down. Now lift your elbow so your fingers dangle. This is what you just did to the photogrammetrist and what I just did to the sailboat image as can be seen in Figure 8.

Conclusion

Hopefully I am leaving you with a better understanding of what an image is and how an image is brought into a CAD/GIS file. You have learned that this is called georeferencing. You have also learned that lines 2 and 3 of a world file do not tell you how an image is rotated. You have learned however, that the first four lines of this world file are the latitude and departure of the sides of the pixel. You also promise that you will be very clear as to the coordinate order when you provide a file to the photogrammetrist. You have also been provided a primer on a least squares coordinate transformation and that this transformation is an inherent part of the true meaning of the world file.

X for Y	Original
0.3	0.7
-0.4	0.1
0.7	0.3
0.1	-0.4
11329.419	11329.419
28800.309	28800.309

Table 5. Swapped XY World File

Figure 8: X and Y swapped

References

American Society for Photogrammetry and Remote Sensing (ASPRS): *Manual of Photogrammetry*, 5d ed. Bethesda, MD, 2004, chap. 13, p.985.

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Wolf, P.R., and C.G. Ghilani: *Adjustment Computations-Statistics and Least Squares in Surveying and GIS*, Wiley, New York, 1997.

Wolf, P.R., and B.A. Dewitt, *Elements of Photogrammetry with Applications in GIS*, 3d ed., McGraw Hill, Boston, 2000. ❖

Thomas A. Taylor, PLS #7512
CLSA Member of the Year

The California Land Surveyors Association (CLSA) is pleased to announce that Thomas A.Taylor, PLS #7512 is the recipient of the **CLSA MEMBER OF THE YEAR** award.

CLSA s goals include fostering high professional ethics and procedures, promoting uniformity of practice and procedures, and increasing public awareness of Land Surveying. CLSA represents all California licensed Land Surveyors in both public and private practice. The **Member of the Year** award was presented to Mr. Taylor for his service to the Association and the profession.

Mr. Taylor was born in Omaha, Nebraska and moved to California in 1980. Shortly thereafter, he completed his education at the University of California — Berkeley, earning a degree in Theoretical Mathematics. Tom began his career with Caltrans as a Transportation Engineering Technician in 1991. After rotational exposure to various functions within the department, Tom decided to pursue a career in surveying and gained licensure as a Land Surveyor in 1999. After the Loma Prieta earthquake, Mr. Taylor spent many hours on the reconstruction of the freeway system. Before moving to Sacramento, he was involved in the establishment of project control throughout District 4, particularly involving the use of Global Positioning System (GPS) technology. Tom s expertise in this area has been recognized both locally and nationally. He has been an invited speaker at presentations sponsored by the California Land Surveyors Association, California Spatial Reference Center (CSRC), California State University — Fresno, Geomatics Engineering, The Operating Engineers Union (Local 3), and others.

Mr. Taylor is currently employed by the California Department of Transportation (Caltrans) as the District Right—of-Way Engineer in Oakland (District 4). Previously, he was the Chief of Survey Standards at the Headquarters Office of Land Surveys (Sacramento). Tom served as the CLSA Cal Trans Liaison from 2003-2005. As such, Mr. Taylor helped facilitate the establishment of The Center of Population commemorative monument at the Buttonwillow Rest Stop on Interstate 5. He also worked closely with the CSRC and CLSA on revisions to the Public Resources Code involving the use of State Plane Coordinates. Before returning to the Bay Area, Mr. Taylor was an active member of the CLSA Sacramento Chapter. There, he was instrumental in the establishment of its first annual Land Surveyor s Review Course designed to assist applicants in the licensing process. Tom continues to remain active with CLSA and is currently the chairman of the CLSA Legislative Committee.

Thomas Taylor embodies the high standards of professional responsibility for which CLSA was organized. His service to CLSA and the profession has been officially recognized by this **MEMBER OF THE YEAR** award.

Thank you from Tom Taylor

Thank you and everyone else involved so much for the "Member of the Year" award that you bestowed on me at the 2006 CLSA conference. As you could tell, I was completely taken by surprise and bewildered by the acknowledgement. I can only say that I wish that I said a few things that day that I will now.

I believe that the surveying profession provides a great benefit to society. This is witnessed by the quality people that work within our profession. Many of our fellow professionals are members of CLSA and all of the CLSA members provide great support to our organization for the betterment of the surveying profession. This is unquestioned and irrefutable.

To receive an award such as this is nothing short of fantastic. However, it is an award for all of the members that donate their time and energy to CLSA. I only happen to be the one that is able to hang it on my wall. I know that all members will continue to devote time and energy to our professional society as I plan to do.

Each and every day for the rest of my life I will have a great felling when I look upon the award and think: Wow, this is my most cherished award that I have or ever will receive. I only hope that all CLSA members realize that their efforts and support to the organization are part of the reasons that make this award so special.

Once again, Mr. President, Thank you for this award.

Thomas Taylor, PLS
CLSA Member

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Online GPS Processing

Several online services are available to process GPS data and solve the positions of points. Two such sites are featured herein.

The National Geodetic Surveying provides the **Online Positioning User Service (OPUS)** which accepts static GPS data for observation sessions two hours in length or longer. This service automatically selects three nearby continuously operating reference stations to tie the submitted observation data collected at an unknown station to the established geodetic network. OPUS accepts both RINEX and most receiver-specific data formats. This service can be found on the Web at www.ngs.noaa.gov/OPUS.

The Canadian Spatial Reference System features a technique known as **Precise Point Positioning (PPP)** where autonomous solutions are achieved. The key to this PPP approach is the use of precise GPS orbit and clock products made possible through an international collaboration of the many agencies participating in the International GPS Service. This information is typically 100 times better than that contained in the GPS broadcast navigation message. PPP accepts both static and kinematic data in RINEX format and has no minimum collection time however at least 15 to 30 minutes is recommended. This service can be found on the Web at www.geod.nrcan.gc.ca/ppp_e.php

Now lets test drive these two systems. Station MAT2 was selected. The published coordinates were obtained from the Scripps Epoch Coordinate Tool and Online Resource (SECTOR) found at csrc.ucsd.edu/cgi-bin/sector.cgi. The RINEX file for the selected date is obtained from sopac.ucsd.edu/cgi-bin/dbDataByDate.cgi.. This file was submitted to both online services. The results are shown in the table below.

	Latitude (N)	Longiude (W)	Ell Hgt	dLat	dLong	dHgt
CSRC	33.856759980	117.436697630	398.312			
PPP	33.856760028	117.436697750	398.283	-0.005	-0.011	0.029
OPUS	33.856759958	117.436697600	398.294	0.002	0.003	0.018

Lat/Long in decimal degrees. Heights and differences in meters

ITRF2000 Coordinates for MAT2 reference epoch 2005 102 (2005.2781)

As you can see, the results for this station are as good as just a few millimeters horizontally and a few centimeters vertically. Now it is your turn to take these services for a test drive with other CORS data or your own observations. ❖

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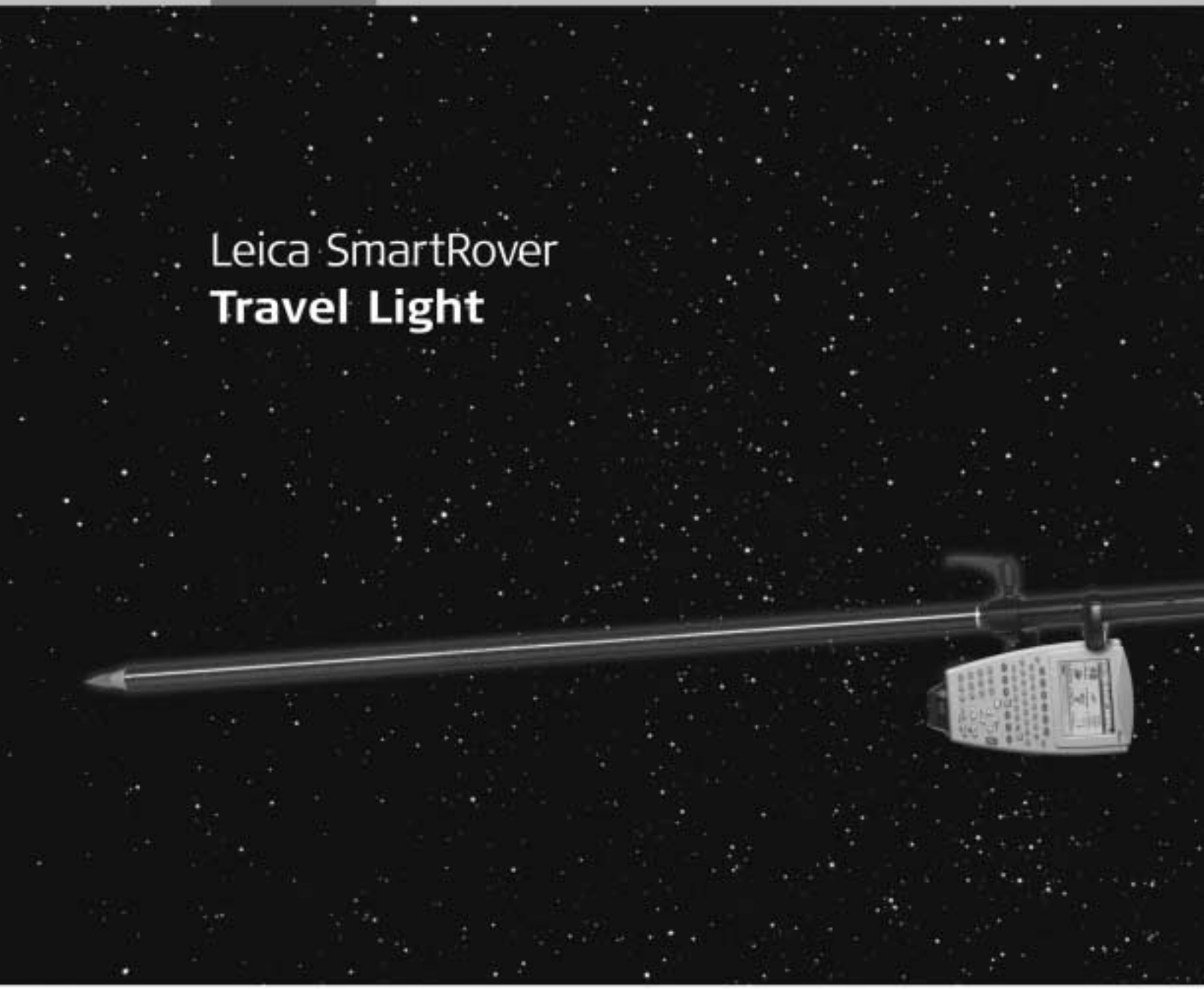

SmartStation

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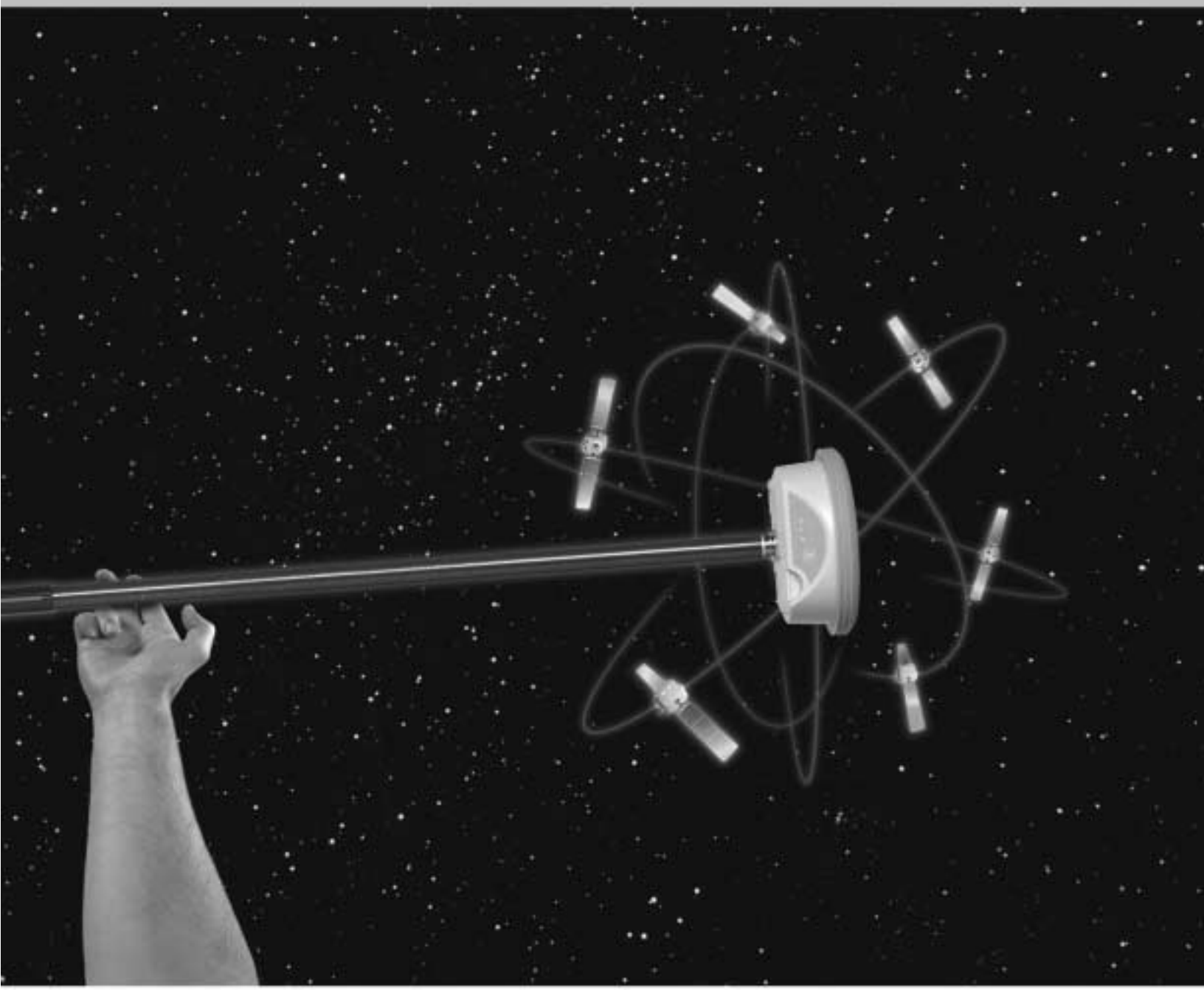

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CLSA Remembers

William H. Young, Age 71,

of Riverside, CA., passed away on 04/04/2006 due to abdominal aortic aneurism at the Saddleback Memorial Medical Center in San Clemente. William was born in 1934 in Sapulpa, Oklahoma. He was Chief of Surveying & Mapping, Riverside County Flood Control & Water Conservation District (1957-1996), President of the Board of Directors of Analytical Photogrammetric Surveys, Inc. (1970-Present) and retired from the County Flood Control in 1996. He was appointed to National Academy of Science, Research Committee on Geodesy in 1992; founding member and past chairman of the California Spatial Reference Center; Executive Committee of the Southern California Earthquake Center's Integrated Global Position System Network. William is survived by wife, Mollie Young, celebrated 50th anniversary last year; 3 daughters, Pamela Young Lee, Long Beach, CA., Amanda Young Alexander, Rolling Hills, CA, Karen Young Henson, Menifee, CA; son, William Michael Young, San Diego, CA; 7 grandchildren. He was preceded in death by his son, Perry Eugene Young. Rosary 04/10, 6:30pm with Mass at 7pm at St. Francis de Sales Church. Buffet reception following Mass in the St. Francis de Sales Church Hall. In lieu of flowers, the family suggests memorial contributions to Mental Health Research Organization (NARSAD) www.narsad.org or Juvenile Diabetes Research Foundation (JDRF) www.jdrf.org.

The following is from a series of E-mails sent by members of the CSRC (California Spatial Reference Center) and general E-mails after learning of Bill s passing.

Bill was a leader and a gentleman. His vision and hard work were instrumental in creating SCIGN and CSRC. He loved his family, his friends, and his work, and was a model for us all in every aspect of life. We will miss him sorely, professionally and personally. I will always remember him. My condolences to his family.

Some very sad news today. Bill was very special and a true asset to the world of surveyors. He will be very missed.

From the year and a half of knowing Bill, I knew him to be passionately committed to his family, friends, and work. His presence and spirit will be greatly missed.

I (we) have learned so much from Bill's professionalism and mentorship. I hope I am able to apply his teachings and uphold his ideals. I share in everyone's loss and sadness. My condolences to Bill's family and many friends.

While many a good man would have just packed it up, set back on their laurels, and retired after the professional career Bill had, it was after his retirement that Bill seemed to be even more focused and more driven to make the surveying profession in California move forward with the times. Bill did this like a man on a mission and it was that kind of leadership and vision that made us all want to follow him. Bill will be irreplaceable.

Bill never ceased to amaze me with his drive and zeal. His passing isa big loss to California, as he had a large impact in the surveying profession.

This is a shock. Bill was the Chief of Surveys and Mapping when I started my first job in surveying at Riverside County Flood Control (1978). He personally shepherded me into the CSRC many years later. A man of incredible energy, innovation, vision. I only got to chat with him briefly at the CLSA conference in Reno and will miss his presence in the surveying world.

Bill was a gentleman and a scholar and always in the vanguard of the profession. He was unassuming and caring and a fine example of a human being. I will miss you dearly Bill.

It was truly very sad news about Bill Young. I got to know him from my days in the Riverside-San Bernardino chapter of CLSA and from other geodetic surveying/educational activities. Bill was indeed a giant and he will be sorely missed.

This is a shock, and very sad news. Bill was extraordinarily innovative and broadminded and competent. He also took the time to be personally interested in the people he worked with. He will be missed.

Very sad news indeed. Although I didn't know Bill well, he was quite inspiring with vision and his drive to get things accomplished. He will be missed dearly.

Bill Young was one of the most genuine people I have ever met. His dedication to his work and wife Mollie are unparalleled. He was a true gentleman in every sense of the word and will be greatly missed by the profession and by all those he touched. My hat is off to you Bill. With deep gratitude and sincere condolences to his family,

I knew Bill for only four years or so. As has been stated, he was visionary, kind, inspiring. He was also willing to assist, selfless and devoted. I was not afforded the luxury of knowing his family. To those who knew him on a personal level, I sympathize with your direct loss. He will be remembered and missed.

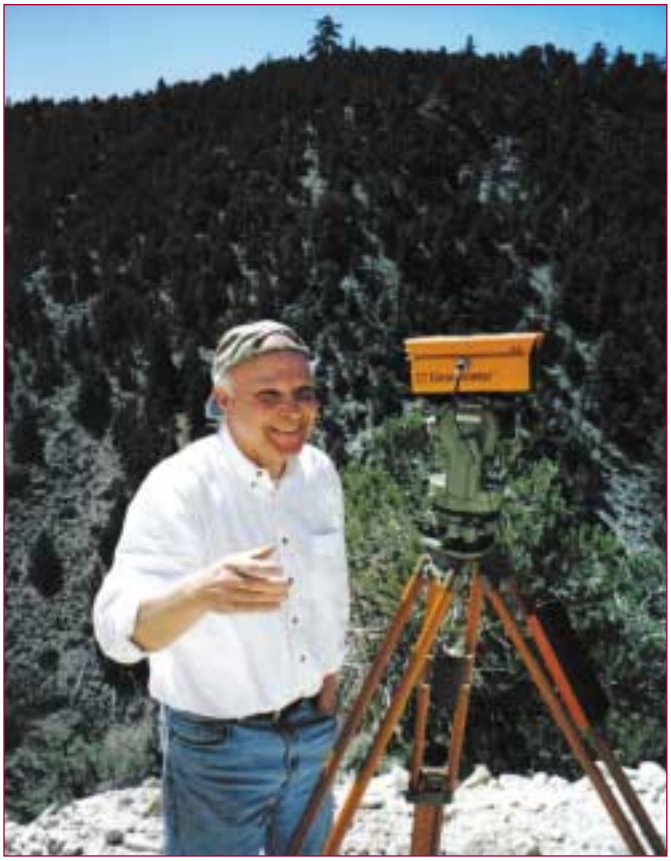
Continued on next page

Francois D. "Bud" Uzes, L.S. 3175
1934 - 2006

It is with utmost sadness that we announce the passing of our dear colleague, Land Surveyor and author Bud Uzes. He died unexpectedly after a surgical procedure on February 7th, 2006.

Mr. Uzes operated his own consulting business called Boundaries Unlimited for 18 years. Prior to that he worked 33 years for the California State Lands Division where he was head of the surveying and boundary determination section. His strong interest in all aspects of land surveying included techniques, education, instructions, laws, and technology.

He has worked as a consultant and expert witness in surveying and boundary disputes in over 100 cases, including twice testifying in proceedings before Special Masters of the U.S. Supreme Court. One



of the cases involved the California-Nevada interstate boundary, which resulted from discrepancies he uncovered while doing research for his 1st edition of Chaining the Land.

Mr. Uzes served 6 years as first president of the Surveyor s Historical Society, was Life Member and Fellow of both the American Congress on Surveying and Mapping and the National Society of Professional Surveyors, and was Honorary Life Member of the Sacramento and Gold Country Chapters of the California Land Surveyors Association. In addition to authoring Chaining the Land, 1st and 2nd editions, he is also the author of Illustrated Price Guide to Antique Surveying Instruments and Books, and was contributing author to several editions of Boundary Control and Legal Principles. He made numerous contributions to published journals.

He was in great demand throughout California and the nation as a speaker at professional surveying conferences, seminars, and other gatherings. Topics of his presentations included: water boundaries, cadastral surveys, historical surveys, antique instruments, fraudulent surveys, interstate boundaries, expert testimony, title and boundary research, and legal issues pertaining to land surveying.

Bud was an avid collector and exhibitor of historical surveying instruments, books, and tools. Surveyors appreciated his exhibits as a rare opportunity to learn about their predecessors. They were also popular among the general public, and have been featured in the California State Museum, Placer County Courthouse, and many other venues.

His final exhibit is still on display at the California State Railroad Museum in Sacramento. It is a diorama that depicts a 19th century survey crew. Those who look carefully will find his image in the attendant mural.

His expertise in historical surveys appeared to have no bounds; his research and field investigations made significant contributions to our understanding of ancient Egyptian and Anasazi Indian surveying technology.

For all of his achievements, he was a humble and gracious man who consistently placed service to the profession above personal recognition. He provided counsel freely to those around him, and through his writing, provided counsel to those he would never meet. Bud Uzes was our mentor and our friend. His devotion and contributions to surveying cannot be overestimated. He showed us, by example, how to live a life of honor, integrity and service. We miss him greatly.❖

Index To Advertisers

Lewis & Clark Update

Winter of 1805/1806

The winter of 1805/1806 found the Corps of Discovery encamped near the mouth of the Columbia River near present day Astoria, Oregon. They called their winter camp "Fort Clatsop". One place that you could visit on a long weekend trip is the national and state historic parks at Fort Clatsop which is a recreation of the original Fort. There is a museum and book store at the park. The website is http://www.nps.gov/focl/home.html.

Across the Columbia River at the southern tip of Washington State's Long Beach Peninsula is the Cape Disappointment State Park and the Lewis and Clark Interpretive Center. The website is http://www.fortcanby.org/visit/lcic.html

October 16, 1805

The expedition reaches the Columbia River, the last waterway to the Pacific Ocean.

Late October 1805

The Corps must run their canoes through treacherous rapids at The Dalles and Celilo Falls.

November 7, 1805

Believing he sees the Pacific, Clark writes, "Ocian in View! O the joy." In reality, they are seeing only the widening estuary of the Columbia River.

November 24, 1805

Having reached the Pacific, the entire expedition—including Sacagawea and Clark's slave, York—take a vote on where to build their winter quarters. They chose the Clatsop Indian side of the Columbia, and the encampment came to be called Fort Clatsop.

March 23, 1806

After a winter of only 12 days without rain, the men present their fort to the Clatsop Indians and set out for home.

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CLSA Distinguished Service Award *Presented to:*

Carl C.de Baca,

CA PLS 5854, NV PLS7633

At the 2006 CLSA Conference, Carl C.de Baca, PLS was awarded the CLSA Distinguished Service Award. This is CLSA's highest award and is made in recognition of the significant contributions Carl has made to CLSA and the surveying profession.

Carl was born in San Francisco, CA and raised in Elko, NV. He began his surveying career in 1980 at age19 as a rodman for a local engineering/surveying firm. In 1985 Carl moved to Reno, NV and worked as a party chief. Carl received licensure in Nevada in 1987 and in California in 1988. His survey background, to this point, was cadastral, mining-related surveys and construction layout. In 1989 Carl moved to Sacramento and spent the next 16 years specializing in land development for three large multi-discipline firms.

Carl became a member of CLSA in1992 and has demonstrated exemplary service to the profession. At the local level, Carl was active in the Sacramento Chapter serving as Chapter President and Newsletter Editor. At the state level, Carl was not only a member of the CLSA Board of Directors but also served as CLSA Liaison to the Board for Professional Engineers and Land Surveyors (BPELS), NSPS Governor, Editor of the California Surveyor magazine, CLSA Secretary and CLSA Treasurer. On a national level, Carl continues to serve as Chairman of the NAFTA MRD Review Committee.

In 2005 Mr. C.de Baca returned to Elko, Nevada and established his own business – Alidade, Inc., specializing in surveying in support of the mining industry.

In addition to his many accomplishments, his integrity and character make Mr. C.de Baca deserving of the high honor of the CLSA Distinguished Service award.

Thank you from Carl C.de Baca

I must confess that this award caught me completely by surprise. I'm not sure that I deserve it but I am deeply honored to receive it and will cherish it always. I have never regretted a moment of participation in CLSA activities at every level. I wish I could have been even more involved. I would encourage everyone to jump in with both feet and participate to the greatest degree possible. You won't be disappointed. CLSA is looking for leaders with insight and drive. If that's you, then by all means, come on board!

My recent move to Nevada notwithstanding, I continue to be a California Land Surveyor and an enthusiastic CLSA member and will continue to contribute to the organization wherever I can. I already miss the fine senses of fellowship and purpose embodied by CLSA and its Board of Directors.

For having me as a member and for the award, Thank You!

CRC

By: Michael A. Duffy, PLS

Where Have All the Surveyors Gone?

A continuing theme I hear among surveyors nowadays is the concern about where the future professionals will come from. Will they come from our universities, through the engineering field, from other states, or even maybe from Canada or Mexico? I believe these types of comments begin from a feeling that we are a shrinking professional group in a rapidly growing state. But is this actually the case? Let s look at some statistics.

Historical speaking, the number of surveyors licensed in California since licensing began in 1891 has been quite small compared to other professions. Though the licensing numbers have increased in the last 30 years they are small in comparison to other professions such as engineering, which have licensed between 1000 to 2000 professionals per year for many years. The following numbers show the licensing trends for California surveyors since they began licensing in 1891:

Years	1891-1929	1930-1969	1970's	1980's	1990's	2000's
Surveyors per Year	45	43	99	134	140	123

The population projections for California add to the overall sense of concern. Taking the average projected rate of population growth from the many study groups and universities you get the following conservative growth rate chart for California:

Year	1990	1995	2000	2005	2010	2015	2020	2025
Pop.	30 mil	32 mil	35 mil	38 mil	40 mil	43 mil	45 mil	47 mil

The County Engineers Association of California recently published a study entitled Strategies for Counties to Accomplish Professional Land Surveying Services . Their immediate concern was filling the office of County Surveyor throughout California. In their study, the Professional Liaison Committee compiled the following figures concerning the declining number of professionals practicing land surveying:

Year	1985	2005	2010	2015	2020	2025
Surveyors	14,000	7,400	5,700	4,300	3,300	2,800

Continued on next page

The driving factor for the decline in the surveyor figures is the number of Civil Engineers who no longer practice surveying or have retired or have died. The engineers who can practice land surveying are declining by about at least 1000 per year. Added to this number is the fact that the licensing rate for surveyors is not keeping pace with the retirement and morality rate, which has reached nearly 150 people per year.

These figures do paint a picture of a shrinking professional survey workforce. Another way of reporting this trend would be with the following statistics. In 1990 there was one practicing licensed surveyor for every 2140 citizens. By 2025 there will be only one practicing licensed surveyor for every 16,800 citizens in the State of California. This ratio reduction makes even less sense in light of the fact that we live in a state that is becoming more and more litigious and that continues to enact more and more laws requiring more professional services relative to land development.

By comparison, there are 52,000 civil engineers licensed in California right now. They licensed over 800 this year compared to the 46 surveyors and are near the 1000 mark often. They have approached the 2000 mark on several occasions in the last 20 years.

Surveyors have debated for years about what the reason is for the shrinking numbers of professionals and what the best solution to this problem might be. I think the problem has become obvious over time if we look at a few more numbers.

In 2005, 492 individuals took the land surveyors examination in California and 46 passed, a passing rate of 9%. In the same year, this group had a passing rate of nearly 50% for the national exam. California typically passes from 10 to 15% of the survey applicants over the years and only rarely achieve a 20% passing rate.

Engineers fared much better in the latest California exam passing about 40% of the applicants. In fact, engineers regularly pass between 40 and 50 % of its applicants year after year in California.

The problem I think is clear. The testing for land surveyors in California is flawed. It has been flawed for sometime. There are either too many questions, not enough time for the questions, too high of a complexity of questions, or too hard of grading of the answers. I believe it is a combination of all of these elements, and that most licensed surveyors seem to be happy with it or are at least ambivalent. I repeat, this is not something new, it has been happening consistently for some time.

The problem with this situation is that it cannot last much longer. It is not a question of what we charge for our services, what kind of business people we are, how well we organize as professionals, or even how much we push for higher education. The fact is when this state hits a point where the professional surveying services are not available to allow for the necessary growth and commerce of the state s economy, someone besides surveyors will come up with a solution and it will not make any of us happy, in that you can be assured.

So I propose we solve the problem ourselves instead of letting someone else do it for us. I believe we should use the national exam for a specific period of time until the numbers of professional surveyors gets to at least the level we had in 1982 when the engineers were banded from land surveying. Then we can re-evaluate our testing format.

If we don t act soon as a group I think we could be seeing engineers or out-of-state surveyors doing land surveying work in California. I think this would be a grave mistake and not in the best interest of the citizens of California or our profession. ❖

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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.

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■ **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.

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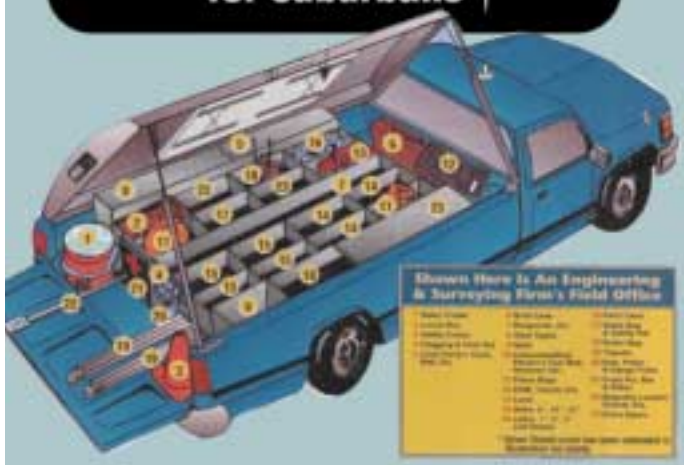

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