HOOSIER SURVEYOR

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PROFESSIONAL LAND SURVEYORS, INC.

VOLUME 19
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SUMMER 1992

AFFILIATED WITH THE
AMERICAN CONGRESS ON
SURVEYING & MAPPING

APRIL MEETING OF I.S.P.L.S. BOARD OF DIRECTORS

Seven members of the twelve-member ISPLS board of directors attended the April 4th meeting in West Lafayette. Seated, left to right, are Chris Marbach (Elkhart); Doug Herendeen (New Palestine); Rich Hudson (Valparaiso); standing: David Blankenbeker (Jeffersonville); E. Donald Bengel (Valparaiso); E.R. Gray III (Columbus); and Randolph Sexton (Kendallville).

EDITOR'S NOTE

Deadlines for copy for various planned issues of the Hoosier Surveyor are as follows: Winter issue-December 31; Spring issue-March 31; Summer issue June 30; Fall issue-September 30.

The Hoosier Surveyor is published quarterly by the Indiana Society of Professional Land Surveyors, to inform land surveyors and related professions, government officials,educational institutions, libraries, contractors, suppliers, and associated businesses and industries about land surveying affairs.

Ar[illegible]d columns appearing in this publication do not necessarily reflect the [illegible] of ISPLS or the Hoosier Surveyors staff, but are published as a s[illegible] its members, the general public and for the betterment of the su[illegible] profession. No responsibility is assumed for errors, misquotes or deletions as to its contents.

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INCOMPETENCE: Challenge for the 1990s

by Dennis Mouland

One of the main purposes for licensing land surveyors is to "protect the public." The entire concept hinges on the licensing board identifying, correcting, or withdrawing licensure from incompetent practitioners. We see this in the medical, legal, and other professions. If the number of surveyors in the country whose license have been revoked is a measure of how much incompetence is being dealt with, one can come to one of only two conclusions: either there is very little incompetence or the governing bodies are not addressing the issue. I tend to lean toward the latter conclusion.

Measuring incompetence within our profession is a very difficult task. We like to think our testing processes take care of the largest percentage of the problem, but this is rather naive.

To test this assumption, ACSM could launch a major study. But how would you do this; make everyone take a survey competency test? What would be on it, and who is qualified to write it? Perhaps we could get a copy of every plat filed with every county and see how many surveyors followed the rules.

This would not be a fair measure, since many surveyors have never filed anything at the court house in their lives. Maybe we could poll the engineers, architects, realtors, and other "users," as an ACSM study did two years ago. In my opinion, however, none of these people are remotely qualified to measure the surveying profession's competence level.

The measurement of competency must be done on a local basis. This is why each state has its own laws, registration boards, and policies.

During the 1990s, even more localized groups will have to begin to deal with the problems. The truth is, in any community, there is a grave concern on the part of a few surveyors that the majority of the profession is incompetent in some facet of the discipline. I share this concern.

There are two fronts upon which we must do battle to deal with incompetence. The first is the initial licensing process. The second is in monitoring and correcting incompetence among those already licensed. Few states have gone beyond attempting to deal with the first. We have all heard the policy of our testing entities that we are "only testing for the minimum entry level." In my opinion, this is sheer folly. The minimum entry level is often ridiculously low. I met the minimum level when I was licensed, but I often wonder if I personally should have been turned loose on the "protected public."

Would you accept this testing policy with medical doctor? We have allowed the term "licensed land surveyor" to mean next to nothing. Our testing procedures, no matter how perfectly worded, only test for limited knowledge. They cannot test for skills, abilities, or understanding. So the end result is a screening of sorts that weeds out the absolute idiots - something I'm sure would reassure the public about their protection.

The types of screenings by the registration boards are usually limited. While they make sure the applicant has all the right references, all the necessary humanities courses, or all the "years" of experience prescribed by law, they are unable to adequately measure the skills of evidence search, the abilities to deal with complex overlapping rights, or the understanding of seniority of calls in a legal description. Test could be expanded to forty-eight hours and you still could not measure all that needs to be measured.

Surveying cannot be minimally tested as the sole method of measure initial compete[nce]. An apprenticeship or sponsorship program ne[eds] to be developed. The tests need to ask more difficult questions that reflect real-life, everyday surveying problems. The references need to be personally queried in detail as to the skill levels of an applicant.

The four-year degree requirement is not the solution to incompetence in the 1990s. It will address ten percent of the problem, at best. I support the degree requirement, but let's not fool ourselves; the majority of the incompetence in our profession is already licensed!

How can we deal with incompetence within our ranks? Establish a nationwide witchhunt? I hope not. There are a few things we must begin to do as a united profession. First, document and remove licensing from those who are willingly ignorant and whose apathy prevents them from ever achieving competence. That means reporting those who perform improper work. It means revoking licenses in a consistent and tough manner.

Each state must absolutely require continuing education to bring every existing surveyor up to a competent level. It means even those who already "know it all" must attend (they can offer encouragement to the rest of us). It means a financial burden to the regist[rant] but it would probably be on the level of a dinner out with their mate two or three times a year.

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BOARD OF DIRECTORS MEETING

April 4th & May 16th, 1992
(Condensed)

The Board of Directors met on April 4th and again on May 16th. Subjects covered included:

The St. Joseph Valley Chapter submitted a revised charter which will add Fulton, Kosciusko, and Marshall counties to the chapter. The Northeast Chapter acknowledged the Initial Point Chapter challenge to provide $200 to the Scholarship Fund and in turn issued a counter challenge to raise the donation to $250.

The 1992 Convention was officially brought to a close with the motion to distribute 10 percent of the convention profit to the Hoosier Hills Chapter. The motion was seconded and passed. Doug Herendeen and David Blankenbeker gave reports on the plans being made for the 1993 and 1994 conventions, respectively.

It was voted to award honorariums to Gary Kent, Wes Day, Don Cochran and Pat Cunningham for their work on ISPLS workshops.

At the April 4th meeting Vincent P. Drnevich, head of Civil Engineering at Purdue University, addressed the Board on the status of [the] Surveying program. His goal is to have the [best] program in the nation. New course requirements will be introduced in pursuit of this goal and to maintain accreditation.

The Public Relations committee reported that it is working on a merit badge for Boy Scouts of America.

Art Haase issued a request for the donation of any old instruments and other equipment for Vincennes University.

Financial matters occupied the Board as various investments came due and it became necessary to consider new investment options. It was decided to place the funds designated to supplement the scholarships into the savings account. The remainder of the Society's money will be divided between the checking account, a money market account, a mutual fund, and a zero coupon U.S. Treasury bond.

The Society's numbers increased with the acceptance of membership applications from: A. Lee Utt, Dennis M. Webb, Phillip H. Smith, and Paul Couts.

A motion made by Chris Marbach will bring to an end fund raising for 1993 scholarships at this time. Chris stated that Marbach and Brady will pick up any shortfall next year after Chapter and Corporate donations [are] made. The motion was seconded and passed.

Mike Crawford, reporter

CHAPTER NEWS

Initial Point Chapter held a meeting at Sam's Restaurant and Grill on May 27, 1992. Tom Boofter suggested that a paragraph be written concerning the nomination of one person per year for the "Long Knife" Award and that this information be submitted to the Hoosier Surveyor. A motion was made and seconded that award notification be made on parchment.

The ISPLS requested that Initial Point Chapter co-sponsor a workshop in January or February of 1993 in Southern Indiana. David Blankenbeker and David Ruckman were placed in charge of a committee organizing this workshop.

Over dinner it was decided that an extra $50 be sent to ISPLS for the Purdue/Vincennes scholarships. The action was taken in response to the Northeast Chapter Challenge. A general discussion of wetlands also took place. At 9:30 Bob Campbell brought the meeting to a close.

INDIANA SOCIETY OF
PROFESSIONAL LAND SURVEYORS, INC.

INITIAL POINT CHAPTER
P.O. BOX 157
JEFFERSONVILLE, IN. 47131-0157

7/8/92

DEAR DIANNE:

ENCLOSED IS A CHECK FOR $50.00 TOWARD THE PURDUE AND VINCENNES ENDOWMENT SCHOLARSHIPS. THIS IS TO MATCH THE NORTH-EAST CHAPTERS CHALLENGE, AND WE ENCOURAGE THE OTHER CHAPTERS TO FOLLOW SUIT. NEXT TIME THE "INITIAL POINT" CHAPTER IS CHALLENGED, PLEASE ASK THE OTHER CHAPTER TO POST A REAL CHALLENGE FOR US.

SINCERELY;

FRANK F. BALLINTYN
INITIAL POINT CHAPTER
SEC./TREAS.

P.S. PLEASE POST IN THE "HOOSIER SURVEYOR".

CONTRACTS AWARDED FOR AERIAL PHOTOS IN 12 STATES INCLUDING INDIANA

Seven companies in California, Hawaii, Missouri, Pennsylvania, South Dakota and Wisconsin have been awarded contracts totaling $3.8 million for the taking of aerial photographs of areas in 12 states, according to an announcement by the U.S. Geological Survey, Department of the Interior, made on behalf of a federal and state interagency group.

Photographs taken under the National Aerial Photography Program (NAPP) are aimed mainly for use in programs of the organizations in the interagency group, but also can be purchased by the public. NAPP photographs have already been taken of about 72 percent of the country.

NAPP contracts for 1992 included an award to Horizons, Inc. of Rapid City, S.D., $612,589 for areas in Alabama, Michigan, Indiana, Mississippi and Wisconsin.

NAPP, begun in 1987, is a cooperative effort by the Agricultural Stabilization and Conservation Service (ASCS), the U.S. Forest Service, the National Agricultural Statistics Service and the Soil Conservation Service, all in the U.S. Department of Agriculture; the Bureau of Land Management and the U.S. Geological Survey, both in the U.S. Department of the Interior; the Tennessee Valley Authority; and individual state contributors.

The contributing agencies have consolidated their aerial photography needs and pooled their resources to reduce costs and duplication of effort. The program is administered by the USGS, with guidance by the interagency NAPP Steering Committee.

Under NAPP, color-infrared and black-and-white photographs are being taken from 20,000 feet above mean ground level with a six-inch focal-length camera. The resulting photographs are at a scale of 1:40,000 (one inch on the pictures represents about 3,333 feet on the ground).

Each photograph covers about 32 square miles, and a set of four will cover the area represented in a USGS 1:24,000-scale, 7.5-minute quadrangle map. Flight lines are north-south with about 60 percent forward overlap between succeeding photographs.

NAPP photographs are used for topographic mapping, drainage studies, geologic analyses, land-use inventories and planning, monitoring of wetlands, soil surveys, agricultural monitoring, measurement of crop areas, studies of transportation patterns, census studies, forestation studies, the detection of blight or insect infestations and a wide variety of other programs and activities.

Under the contracts, photographs will be taken during seasons with leaves on or off the deciduous trees, depending on requirements of the requesting agencies.

For information on how to obtain NAPP photographs, contact the USGS Earth Science Information Center (ESIC), EROS Data Center, Sioux Falls, S.D. 57198, telephone 605-594-6151; or the USDA-ASCS, Aerial Photography Field Office, P.O. Box 30010, 2222 West 2300 South, Salt Lake City, Utah 84130-0010, telephone 801-524-5856.

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INCOMPETENCE
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But most of all, to deal with incompetence in the 1990s in our profession we must have the guts to admit that it is there, and that it is a far greater problem than most realize. Let's deal with it now before the public catches on and deals with it in their own way. Our "profession" might not survive that! Are you interested enough in your profession to deal with this at your local level? That will be the real test as to whether surveying is a profession or not. Apathy at the local level will determine whether incompetence will be eliminated in the 1990s.

Dennis Mouland is a regional land surveyor for the USDA Forest Service, Southwestern Region. He is also president of Cadastral Consultants, Inc., a boundary consulting and survey education service in Albuquerque, New Mexico.

Reprinted from California Surveyor, Fall 1991.

COMPUTER USE QUESTIONNAIRE

The following questionnaire is being distributed by the Education Committee of the Indiana Society of Professional Land Surveyors, Inc. The results of this research will be reported back to you in an article in the Hoosier Surveyor. The Education Committee also will use the results to plan a workshop.

Do you use GPS equipment? [ ] yes [ ] no
Hardware _____

Do you use a total station? [ ] yes [ ] no
Hardware _____

Do you use a data collector? [ ] yes [ ] no
Hardware _____

Do you use a computer system? [ ] yes [ ] no

Hardware: computer _____
monitor _____
printer _____
plotter _____
digitizer _____
modem _____
peripherals _____

Software: GPS _____
data transfer _____
communications _____
coordinate geometry _____
contouring _____
CADD (drafting & design) _____
GIS _____
closure adjustment _____
word processing _____

..continued next page

Computer Questionnaire

Do you use a computer system?

Software: description writing _____

celestial observation _____

List any hardware and/or software you would like to note that we forgot to ask about.

_____

_____

_____

List any hardware and/or software (type and/or brand) you plan to purchase yet this calendar year.

_____

_____

_____

Make any comment regarding the hardware and/or software you are now using or own but do not use. (suggested comment ideas: support, ease of use, suitability for purpose, price/performance, and quality of training material)

_____

_____

_____

_____

Tell us about your firm.

Services offered _____

Number of employees _____

Additional space for your use; use additional sheets if need.

_____

_____

_____

_____

_____

Thank you for taking the time to share with us and your fellow surveyors your knowledge and experience in these matters.

Please return your completed computer questionnaire to:

ISPLS Headquarters
55 Monument Circle, Suite 1222
Indianapolis, IN 46204

NEW FORMAT GEODETIC CONTROL DATA SHEET

A comprehensive new format for publishing geodetic control data is available. The new geodetic control data sheets combine horizontal control (position) and vertical control (orthometric height) information in a single published format. Paper copy data sheets are distributed in blocks of 7 1/2 minutes of latitude by 7 1/2 minutes of longitude, corresponding to the U.S. Geological Survey's series of topographic maps.

The new data sheets include: (1) control point designation and permanent identifying number, (2) horizontal or vertical datum, (3) horizontal coordinates and method of determination, (4) orthometric height and method of determination, (5) horizontal datum shift (NAD 83 minus NAD 27), (6) vertical datum shift (NAVD 88 minus NGVD 29), (7) type of mark used and how set/stamped at the control point, (8) geoid height, ellipsoidal height, modeled gravity, and LaPlace correction, (9) state plane coordinates and Universal Transverse Mercator coordinates, (10) a description of the mark's location and how to reach it, and (11) a history of when the station mark was recovered, the condition in which it was found, and updates to the station description from the recoveries. Prices range from $20 to $120, depending upon the number of stations included.

ASCII data sheet files, similar to the data sheets, also are available on 3 1/2" or 5 1/4" high-density computer diskettes for counties or 7 1/2 minute blocks for $98 each.
Inquiries: National Geodetic Information Center
(301) 443-8631

GEODETIC INFORMATION PRODUCT UPDATE NEWS

The updated version of NADCON, the coordinate conversion program software between the NAD 27 and NAD 83 coordinate values, is now available. Version 2.10 also allows users to convert coordinate values between NAD 83 (1986) and state High Accuracy Reference Networks (HARN) for those states which have adjusted HARN positions.

Version 4.0 of program ADJUST performs a least squares adjustment on a prechecked "Blue Book" data file in the "new" Blue Book format, that is, with four-digit station serial numbers. Previous versions of ADJUST accepted only three-digit station serial numbers. Using this version of the program requires a 386-based personal computer with 640 kbytes of random access memory on the mother board and at least 4 Mbytes of available random access memory, a math coprocessor, and MS DOS 3.3 or higher.

New HP-41 CV calculator software programs are now available to perform geodetic inverse and forward computations for any ellipsoid. Program 53-41, Geodetic Inverse, computes the geodetic azimuths (forward and back) and distance between two points for any ellipsoid, given the latitude and longitude of both points. It replaces HP-41 CV program 55-41. Program 52-41, Geodetic Forward, computes the latitude and longitude of a point, for any ellipsoid, given the latitude and longitude of a starting point, forward geodetic azmuth, and length of the line between the points.

Prices for the first two of the above programs are $98; the third program is $30.
Inquiries: National Geodetic Information Center
(301) 443-8631

HIGH-ACCURACY REFERENCE NETWORK IS BEING ESTABLISHED

Using Global Positioning System (GPS) instrumentation, NGSD is working cooperatively with many Federal, state, and local agencies, academic groups, and private industry to establish a network of high-accuracy reference stations. This set of high-accuracy reference stations, established thus far on a state-by-state basis, will allow the surveying and mapping communities to take full advantage of the technology revolution created by GPS and modern computing capabilities.

The stations of this network are normally located 25 to 100 km (15 to 60 miles) apart and will have NAD 83 (North American Datum of 1983) horizontal positions, with differential positions accurate locally at the 1 - 3 cm level and absolute positions relative to the NAD 83 coordinate system accurate to the 5 - 10 cm level. Since GPS is 3-dimensional, these stations also will have a vertical coordinate (ellipsoid height) associated with them. These ellipsoid heights can be converted to orthometric heights, the quantity obtained from leveling surveys, using geiod height information. NGSD currently publishes such geoid information from the high-resolution geoid height model known as GEOID90. This geoid can provide 1 cm accuracy between points 10 km apart.

This high-accuracy reference network is not independent of the existing NAD 83 reference network, but rather is an upgrade of it. The high-accuracy network in a state is linked to stations of the existing reference network at intervals of 100 km or less, which requires a complete readjustment of the existing statewide reference network, holding fixed the

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ESTABLISHING A GEODETIC CONTROL NETWORK TO SERVE AS PHOTOGRAMMETRIC CONTROL FOR A COUNTYWIDE GIS

The following paper was presented at the 78th Annual Purdue Road School, March 10-12, 1992, and is reprinted by permission.

By Michael J. Stanoikovich
Manager of Geodetic Services
Woolpert Geographic Information Services Division

BIOGRAPHICAL SKETCH

As manager of geodetic services for Woolpert Geographic Information Services Division, Mr. Stanoikovich is responsible for overseeing daily geodetic operations. He specializes in projects for infrastructure applications, projects that require significant ground control, and other field surveying services such as GPS satellite surveying. He ensures that projects are performed according to client requirements and completed within the specified schedule and budget. His experience includes Global Positioning System (GPS) surveys; photogrammetric control; and utility, boundary, topographic, and geodetic ground control surveys.

Mr. Stanoikovich has performed geodetic services for the City of Cincinnati, Ohio; the Cincinnati Area Geographic Information System (CAGIS); Delaware County, Ohio; Fairfield County, Ohio; Butler County, Ohio; Lorain County, Ohio; Ottawa County, Ohio; Geauga County, Ohio; Sandusky County, Ohio; Bartholomew County, Indiana; and other clients in the United States and South America.

Woolpert is a multidisciplinary firm with capabilities in engineering, photogrammetry, architecture, planning, and landscape architecture. These capabilities enable Woolpert to provide Geographic Information Services, Public Works and Infrastructure Services, Aviation Services, and Environmental Services. The firm, which has 13 offices in nine states and employs more than 500 people, has been in business since 1911 and is based in Dayton, Ohio.

ABSTRACT

The surveying industry has seen many changes in the past decade. The total station was a great addition to the profession, along with sophisticated data collectors and unmanned instruments that use radio-based tracking and servo motors. But perhaps the most important addition to the geodetic surveying community was the introduction of the Navstar Global Positioning System (GPS), allowing the surveying industry to establish affordable, high-accuracy geodetic control. These new technological developments, along with the skills of trained professionals, will aid in the establishment of a geodetic/photogrammetric control network for cities, states, and counties that plan to implement a Geographic Information System (GIS) or some other type of mapping project.

INTRODUCTION

With the term "GIS becoming as common among government agencies as elections, the need for knowledge and understanding of the GIS concept becomes more important. "You get what you put into it" holds true in life as well as in a GIS of any type.

Because so many agencies are getting involved with GIS technology, it is important to understand the vital role played by a control network in planning and creating a GIS. This paper examines three categories of control networks by evaluating their relative costs, accuracies, and recommended applications. It also provides step-by-step guidelines for planning a GPS control network.

THREE TYPES OF NETWORKS

The foundation of the GIS is its geodetic control base. This framework of geodetic positions establishes the accuracy to which all other data is related.

For a control network that serves as the basis of a GIS, the old adage about a chain and its weakest link is very appropriate: The GIS itself can only be as accurate as its control network. No amount of software and hardware enhancement can compensate for control that is not accurate enough for the required uses.

There are three types of GPS control networks: surveying/engineering, photogrammetric, and dual-purpose.

Surveying/Engineering GPS Control Network

This network consists of a series of stations that are usually laid out in a grid-type pattern (however, a rectangular grid is not necessary). Many city and county agencies choose this method, using sectionalized land corners as the station grid. This method has been used by many counties throughout the U.S. and has been proven as a strong reference base to support a GIS. Franklin County, Ohio, is one of the best examples of this type of network in the state of Ohio.

However, one of the drawbacks of this system is that it is expensive to create. Section corners must be located or re-established, permanent monuments must be placed at the location, and, if the corner falls in a roadway or a developed area, some type of monument box and/or protective feature must be added to ensure its stability. Also, it is important to consider the safety issues involved in trying to occupy stations situated in the roadway. This applies both to GPS crews establishing the position of the station and to surveyors using the station for other surveying purposes.

Another network that falls in this category is one that consists of stations placed either in municipal parks and recreation areas or on the grounds of community school board property. This type of geodetic station layout has been used quite effectively by the City of Cincinnati, Ohio. This method has several advantages, one of which is the unlikelihood of disturbance to the station due to construction. Another is that the areas are easily accessible and - depending on the neighborhood - are usually safe to occupy even during nighttime observation sessions. This network is considerably less expensive to set up than the first type of network, but the GPS portion of the project is equivalent.

Following the Federal Geodetic Control Committee's *Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques* (Version 5.0 or the latest version), accuracy standards for this type of network should not be less than 1 part per 100,000.

Photogrammetric Control Network

When GPS control is needed to support a digital mapping project, orthophotography, or both, control location is determined by the needs of the photogrammetrist. Most photogrammetric firms that perform fully analytic triangulation use a perimeter control pattern.

This approach allows the photogrammetrist to control the mapping project from high-altitude photography, which minimizes the amount of horizontal and vertical control needed. This yields an acceptable fully analytic triangulation result without deteriorating the accuracy of the project. Some of the points are positioned along the sides of the project (parallel to the flight line of the aircraft). The majority of the stations, however, are placed along the sides of the project that contain the beginning and end of the flight lines.

This layout offers the lowest-cost alternative for obtaining photogrammetric control. However, it does not meet the requirements of a strong geodetic control foundation to support and maintain a GIS in the years ahead. Another drawback to this network is that the accuracy needed to support the mapping portion of the GIS is not sufficient to support the surveying/engineering demands of a GIS. For these reasons we will discuss the third - and perhaps the most versatile - type of control network.

Dual-Purpose Geodetic/ Photogrammetric Control Network

This type of control network supports a variety of users. One of its greatest assets is that it meets both the photogrammetric needs of a GIS and the higher-accuracy control needs of the surveying/engineering community. This is especially important because the dual-purpose type of network can be significantly less expensive than the surveying/engineering type, and costs can often be distributed among the participants in a GIS project.

Accuracy requirements for this type of network should not be less than 1 part per 100,000 (this accuracy can be achieved easily using GPS techniques).

The network pattern is laid out in much the same manner as the photogrammetric control network. However, in the dual-purpose network, inner control is added as well as possible station pairs or station azimuths. If lower-altitude photography is needed for urban/suburban areas, additional control should be laid out in these areas. This will meet the needs of the photogrammetrist while adding to the density of the control pattern. If only one scale of photography is designated, it is still advantageous to place inner network control near areas of expansion and growth as well as small rural communities while still maintaining some type of rectangular grid pattern.

Once the network pattern has been established, further densification can be made either through terrestrial techniques or through GPS. But whatever method of densification is chosen, this method accommodates both the GIS of today and the GIS of tomorrow.

In fact, it is very important to plan for the future needs of a GIS. Continuous updates will be needed in areas of expansion and growth. These updates will require new photography, geodetic control, and mapping. Previously established control stations can be targeted to help support the analytic triangulation phase of the update process.

In the GIS of the future, all boundary surveys, construction projects, and so on, should

relate to the coordinate system of the geodetic control network. This process has the benefit of adding data that is far more accurate than the original digitized land information data.

Through methods that use the dual-purpose control network, the accuracy of the overall GIS can be efficiently and cost-effectively enhanced. This means that the dual-purpose network is an investment in the future, and represents the best value for the GPS dollar spent.

PLANNING A CONTROL NETWORK

There are several questions to address when planning a control network:

1. **What are the intended uses or applications of the network?**
   This step may require meeting with all potential users to determine their level of interest, their requirements, and their existing information base. It may also be the ideal time to discuss potential for budgetary commitment.

2. **What are the accuracy requirements of the network?**
   The accuracy used will probably be influenced by factors that include planned uses and available budget.

The Federal Geodetic Control Committee (FGCC) defines three broad categories of accuracy for geodetic control networks. The table below provides a brief overview of these categories and shows how they relate to the three types of networks described earlier.

For more detailed specifications on these types of control, see the FGCC publication *Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques*, which was used as a resource for the information presented here.

With GPS capabilities, no control should be established with accuracies less than 1 part per 50,000. In fact, it is recommended to require accuracies of not less than 1 part per 100,000. In most cases, the cost difference between the two accuracy levels is minimal.

Description	Minimum Accuracy	Recommended Uses	Type of Control Network
First-order horizontal control network	1 part per 100,000 (1:100,000)	Called the Primary Horizontal Control, this is the framework for the National Horizontal Control Network. It is recommended for metropolitan area surveys and scientific studies.	• Surveying/ Engineering GPS • Dual-Purpose Geodetic/ Photogram-metric
Second-order horizontal control network	• Class I: 1 part per 50,000 (1:50,000) • Class II: 1 part per 20,000 (1:20,000)	• Class I, Secondary Horizontal Control, is an area control that strengthens the National Network. It is recommended for subsidiary metropolitan control. • Class II, Supplemental Horizontal Control, is used to establish area control that contributes to but is supplemental to the National Network.	Photogrammetric
Third-order horizontal control network	• Class I: 1 part per 10,000 (1:10,000) • Class II: 1 part per 5,000 (1:5,000)	Called Local Horizontal Control, this pertains to general control surveys referenced in the National Network. It is recommended for local control surveys.	Low-end Photogrammetric

3. **What is the available budget for the project?**
   Using the budget information gathered from the users identified in answer to question 1, determine the available budget for the project.
4. **Which of the three networks will be established?**
   Based on information about applications, accuracy requirements, and available budget, the next step is to choose the type of network. Taking the time to answer the first three questions carefully should make the choice of network fairly simple and straightforward.
5. **Should the network data be included in the National Geodetic Reference System (called "blue-booking")?**
   This question also concerns the issue of accuracy. It is recommended that the initial network information be submitted for inclusion into the National Geodetic Reference System (blue-booking), but only if the survey meets the above accuracies. One of the many advantages to blue-booking the control data is this: Once the data has been accepted by the National Geodetic Survey (NGS), it is maintained, updated, and published by the NGS and is not affected by political restructuring in the years to follow.
6. **What are the forecasted costs of the project, and how can the costs be minimized?**
   Now that many facets of the project have been decided, it is possible to forecast the project budget. For this step, it is important to understand that costs can vary greatly due to the demands and constraints of the project, and no hard-and-fast price per station can be set for any one project.

   In these days of tighter budgets, cost control is critical. Although final project costs vary considerably, there are many ways to minimize costs. Perhaps the most efficient method of cutting the final cost of a project is for the agency itself to complete the station locations, reconnaissance, visibility studies, monumenting, and referencing. When these tasks are performed by the agency, the savings can reduce the final project cost by as much as 50 percent.

Who can provide assistance in planning the project?
Two valuable sources of assistance are contractors and the NGS itself. Many contractors offer geodetic services, and most of them are glad to assist in planning a geodetic control network that will meet the agency's needs.

For preliminary ideas and information, contact the NGS advisor in your state. (If one is not available, contact the NGS headquarters in Rockville, Maryland.) An NGS advisor can provide valuable information about similar projects taking place in your state. Contact the agencies identified for ideas that will help you determine your final plan.

CONCLUSION

The three types of GPS control networks discussed provide different levels of accuracy, serve different types of applications, and require different budget commitments. At the high end of the scale is the surveying/ engineering network, which is expensive but extremely accurate. It serves as a strong reference base for a GIS and future surveying and engineering needs. At the other end of the spectrum is the photogrammetric control network, which represents a low-cost approach; however, the accuracy is insufficient for many uses of a GIS. A good compromise is the dual-purpose network, which provides sufficient accuracy for surveying/engineering applications at a lower cost.

Careful planning is the key to choosing the right type of network. Answering the questions about applications, accuracy requirements, and potential budget should guide the choice of network. Then with the type of network decided, answers to questions about blue-booking, projected costs, and sources of planning assistance can help ensure the success of the overall project.

Finally when initiating a countywide or citywide control network, the agency should remember that the actual GPS portion of the project is only part of the total network cost. When implemented properly, the network will meet the needs of all area GIS users well into the 21st century.

BIBLIOGRAPHY

Federal Geodetic Control Committee. *Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques.* Version 5.0, August 1, 1989.

Federal Geodetic Control Committee. *Horizontal Control Data.* Vol. 1 of *Input Formats and*

GEODETIC CONTROL NETWORK

Specifications of the National Geodetic Survey Data Base. January 1989 (blue-booking).

RESOURCES FOR ADDITIONAL INFORMATION

Mr. David A. Conner
Ohio State Geodetic Advisor
National Geodetic Survey
c/o Center for Mapping
1212 Kinnear Road
Columbus, Ohio 43212

National Geodetic Information Branch
N/CG174 Rockwall Building, Room 24
National Geodetic Survey
National Oceanic and Atmospheric Administration
Rockville, Maryland 20852

* * * * *

HIGH ACCURACY REFERENCE
...continued from page 7

high-accuracy network positions. The result is an upgraded, completely compatible, statewide reference network that includes all of the existing network stations, as well as having more accurate NAD 83 coordinates.

Currently seven states, Delaware, Florida, Maryland, Oregon, Tennessee, Washington, and Wisconsin, have high-accuracy networks in place. In seven additional states, Alabama, Alaska, California, Colorado, Idaho, Montana, and New Mexico, observations have been completed and network computations and adjustments are underway. Field surveys are underway in Alabama and Louisiana. NGSD is currently working with six additional states that are planning to initiate high-accuracy network activities over the next 12 months. These states are Kentucky, New Hampshire, Texas, Vermont, Virginia, and Wyoming.

State and county groups and private sector surveyors in Florida, one of the first states to receive high-accuracy network results (in 1990), are reporting substantial use of these networks. Users there report they are recognizing both increased ease of operations and cost reductions resulting from the upgrad NAD 83 reference network. Users in other states with high-accuracy reference networks also are beginning to report substantial use of these networks.

Inquiries: Mr. William Strange, Chief Geodesist (301) 443-8100

ISPLS Fall Workshop - October 2, 1992
"LAND TITLE SURVEYS"

The Minimum Standard Detail Requirements for ALTA/ACSM Land Title Surveys are in the process of being revised for the third time since 1962 and changes in the Minimum Standard Detail Requirements for Indiana Land Title Surveys are being contemplated for the first time since 1970. Learn about these changes at the fall workshop being held October 2, 1992 at the Canyon Inn in McCormick's Creek State Park.

Land title surveys are an important part of your local economy. Discover some things you and other professionals in your community may be able to do to improve the overall process - minimize the time and cost and maintain the requisite quality.

Mr. Richard W. Dyar with Stark Doninger & Smith, an Indianapolis law firm, will discuss land title surveys from the lender's counsel perspective. Discover what a lender's counsel looks for before giving an opinion to the lender.

As the Chief Financial Counsel for Melvin Simon and Associates, Mr. James A. Schmidt has dealings with land surveyors across the United States. Find out what speeds up and what slows down a survey's acceptance.

Mr. Gary R. Kent with Schneider Engineering Corporation will report on the recent changes in the Minimum Standard Detail Requirements for ALTA/ACSM Land Title Surveys. If you have been reading the many articles in some of the professional publications, you know there are many differing opinions regarding the meaning of some of the requirements in the current (1988) requirements. Learn about what changes were made in the "ALTA Survey" requirements.

Mr. Gordon L. Richardson with American Consulting Engineers, Inc. will compare the current version of the Minimum Standard Detail Requirements for Indiana Land Title Surveys with the proposed version. The current requirements have served the profession and our clients well for over twenty years. Find out about the changes being made.

We intend to have a title insurance company representative to discuss the concerns of the title insurance industry and a lender to discuss the concerns of the financial community.

The presenters will each have a period to discuss their topic and answer a few questions. After the presentations, a panel will discuss some of the issues regarding land title surveys; finally, there will be a general question and answer period.

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NSPS GOVERNOR'S REPORT

Boy Scout Surveying Merit Badge
by E.R. Gray III, L.S., Columbus, IN

As I reported in the last Governors Report, the Boy Scout Surveying Merit Badge requirements have gone through a rewrite. Below you will find a list of the new requirements that must be met in order for a Boy Scout to be awarded the Surveyor's Merit Badge.

NSPS and ACSM through the initiative and hard work of Murray Manley, Colorado, and Curtis Summer, Virginia are responsible for the rewrite of the Surveying Merit Badge requirements and Surveying pamphlet. The requirements and pamphlet are dedicated in memory of Mr. Manley, whom passed away during the rewrite process.

The Surveying Merit Badge pamphlet includes topics on: safety, measurements and instruments, how land is described, measuring angles, surveying a lot, drawing a map of the survey, leveling, measuring inaccessible distances and heights, and careers in surveying.

The pamphlet which includes the minimum Badge requirements, suggest that at least three scouts work together with the Surveying Merit Badge Counselor for their Badges. Check with your local Boy Scout Leaders to find out how you can become a "Surveying Merit Badge Counselor" or assist in helping a scout meet the requirements.

Keep in mind that most of the "new" surveying pamphlets may still be at the printer as of this writing.

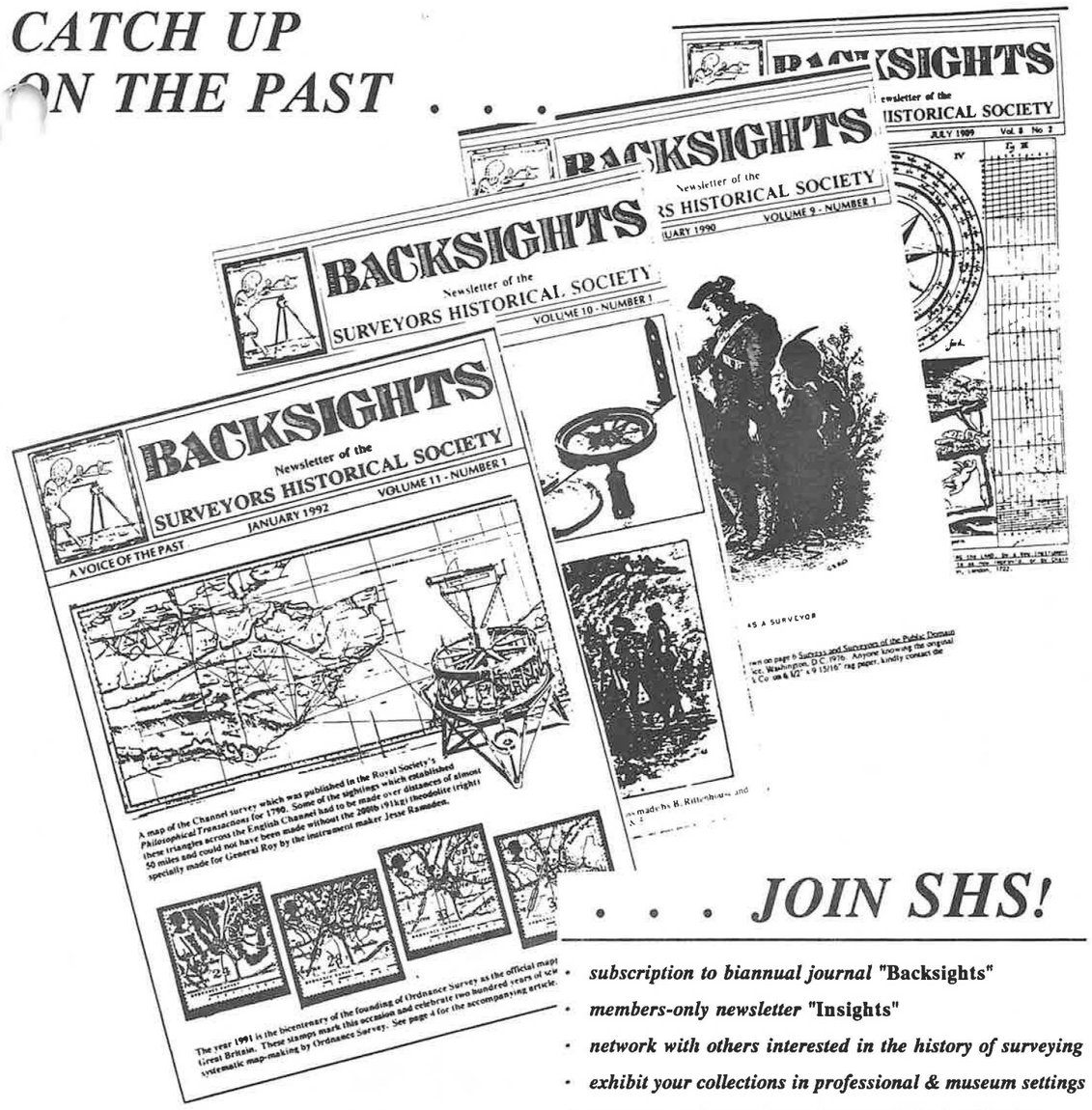
REQUIREMENTS

1. Do ONE of the following:
   a. From a set point (stake, nail, etc.), measure a range line north 300 feet and south 300 feet. From the same point, measure a baseline east 300 feet and west 300 feet. From one or more points (stations) along the range and/or baseline, take compass readings to trees, shrubs, and rocks. Take measurements from the range or baseline to the located features. Make the measurements using instruments, methods, and accuracies consistent with current technology, as directed by your merit badge counselor.
   b. Find and mark the corners of a five-sided lot that has been laid out by your counselor to fit the land available. Set an instrument over each of the corners and record the angle turned between each line and the distance measured between each corner. With the assistance of the counselor, compute the error of closure from the recorded notes. The error of closure must not be more than 5 feet. From the corners, take compass readings or turn angles to trees, shrubs, and rocks and measure to them. All measurements should be made using instruments, methods, and accuracies consistent with current technology.
2. From the field notes gathered for requirement 1, draw to scale a map of your survey. Submit a neatly drawn copy.
3. Use one of the corner markers from requirement 1 as a benchmark with an assumed elevation of 100 feet. Using a level and rod, determine the elevation of the other four corner markers.
4. Without first measuring the distance, determine the length between two points, then measure the length using a tape or instruments consistent with current technology. The answer you first determined must be within 5 percent of the length measured.
5. Determine the height of a point (such as a tree limb) that can be checked using a tape or level rod. Check the height using instruments and methods consistent with current technology, as directed by your counselor. Your original determination must be within 5 percent of the measured height.
6. Discuss the importance of surveying with a licensed surveyor or another qualified individual. Also discuss the various types of surveying and mapping, and applications of surveying technology to other fields. Discuss career opportunities in surveying and related fields. Discuss the qualifications and preparation for such a career.

CORRECTION

In the last Governor's Report the re-elected NSPS Secretary is Bob Prescot rather than Bob Foster.

CATCH UP ON THE PAST . . .



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INSURING YOUR COLLECTION

By Mary M. Root, Editor BACKSIGHTS, Surveyors Historical Society

There is a turning point in your collecting years, that signals the end of an innocent era, and marks the beginning of an era of responsibility to the collection. When your collection begins to assume a cohesive identity, and you realize that prices are going up rapidly, you'll probably do a mental calculation of how much it's worth. If it's over a thousand dollars, then it's worth insuring.

A deluxe homeowners policy, which covers an entire reconstruction of your home, and much of its contents DOES NOT cover the value of your antiques and books. To the insurance company, an antique desk or an old book is just "used" until proven otherwise. In other words, a tragic fire could be disastrous, because your copy of Gummere's Treatise on Surveying will yield about one dollar from your insurance company. You must add what is known as a "rider" to your homeowner's insurance policy. This is commonly done for jewelry, coin or stamp collections, antiques and books, and the like. With a respectable insurance firm, a "rider" will only add ten to twenty-five dollars per year to your home fee. To begin, your insurance agent must have a written appraisal from a reputable dealer in your field. (Call your agent for details and contact a specialist to perform the appraisal, as these things vary by locality and firm). The following are a few suggestions to get you started.

For your collection of antique surveying instruments, make notes on each piece. Record the make, model, serial number, specific features, and where and when it was purchased, and for how much. Take photographs or make a video. Then proceed with the appraisal and the rider to your policy.

For your book collection, it will save time and money if you input your collection on a computer first. A reputable book appraiser will generally charge $25 per hour. The appraiser I contacted said "the more typing you do, the less typing at $25 per hour I do". His instructions were to input: Author-last name first, Title, Date, Publisher, and Publisher Location, in that order, and to skip three spaces between entries. Then I am to send him the diskette and he will print it out and make his notes in the spaces provided. After this preparation, he will visit my home and look through the books. The finished product, a written appraisal, will be mailed to me shortly thereafter.

Keep abreast of current market values in order to upgrade your insurance needs every few years.

"An ounce of prevention is worth a pound of Cure".

- Proverb

Taken from Backsights, Surveyors Historical Society publication, Volume 11, Number 2, July 1992.

* * * * *

STATE SURVEYORS HISTORICAL SOCIETY OFFICERS MEETING

Officers of the Indiana Surveyors Historical Society met in West Lafayette on April 4, 1992. Seated, left to right, are Roger Woodfill, president; and Scott Zeigler, secretary; standing are Hal Ashton, E.R. Gray, III, Randy Sexton, Chris Marbach, and Ken Curtis.

WALTER J. "JOE" SMITH Sr., 57
Member Dies

Walter J. "Joe" Smith Sr, 57, Pittsboro died Saturday, July 18, 1992. Services were held on Tuesday in the Hampton-Gentry Funeral Home in Plainfield. He was a land surveyor for United Surveying Inc. for the past six years. Previously, Mr. Smith was a surveyor for American Consulting Engineering Inc. for 20 years. He also was an Air Force Veteran.

JIMMY D. HUFFORD, 60
P.E./L.S.

Jimmy D. Hufford, 60, Noblesville, died Tuesday, June 9, 1992 at Noblesville Healthcare Center.

Mr. Hufford was born July 17, 1931, in Pacific Grove, California. He had lived in Noblesville since 1978. In 1987 he retired as a Hamilton County Highway engineer. He had worked for the county since 1974.

Mr. Hufford was a member of Our Lady of Grace Catholic Church, the Society of Professional Engineers, and Knights of Columbus. He was a Korean War veteran.

Mr. Hufford graduated from Purdue University School of Engineering.

* * * * * *

SURVEYORS HELP POLICE CONVICT SPEEDERS

Speeders beware. Getting out of a speeding ticket by questioning the accuracy of some of the Maryland State Police's speed measuring instruments might not be as easy as before. According to *Maryland Roads*, the plats and surveys division of the Maryland State Highway Administration (SHA) has been at work measuring and certifying as accurate the distances of half-mile courses used each day by state troopers to calibrate their speed measuring equipment before going out into the field. The instruments, called VASCAR (Visual Average Speed Computer and Recorder) units, are used in place of radar to compute motorist's speed. To measure the 50 to 60 courses throughout the state, surveyors have been using EDM (electronic distance machine) lasers employed in all surveying done by SHA.

Reprinted from Roads & Bridges/September, 1991

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_____	Manual No. 6. Establishment of Boundaries by Unwritten Methods by Darrell R. Dean Jr. and John G. McEntyre (June 1976), 171 pages.	$15.00	$20.00
_____	Early Indiana Trails and Surveys by George R. Wilson, E.E., L.L.B.	$7.95	

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ISPLS SPRING WORKSHOP APRIL 24, 1992

Valparaiso University, Valparaiso, Indiana
by Tony Gregory, LS, Hobart, Indiana

On Friday, April 24, 1992, ISPLS presented a workshop on the Legal Responsibilities of the Land Surveyor at Valparaiso University in Valparaiso, Indiana. Ron Hansell, ISPLS's attorney, was the keynote speaker. He was joined by Don Cochran, a surveyor and attorney from Northwest Indiana, and Pat Cunningham, who represented the State Board of Registration for Land Surveyors. Various legal topics were covered, and there were 52 in attendance. The workshop was very interesting and informative, and the speakers should be commended for a job well done. Those in attendance received 5 Professional Development Hours.

This workshop was sponsored by the Northwest Chapter of ISPLS. Don Bengel, Bob Bigelow, Tony Gregory, Rich Hudson, and Mike Marlow served on a chapter committee to organize the event. The chapter was responsible for coordinating the subject matter with the speakers, securing arrangements at the university, and preparing flyers and mailing lists. In the past, all of this has been done by ISPLS headquarters and the Education Committee. It is hoped that other chapters will sponsor future workshops. Interested chapters should contact either Dianne Bennett at headquarters or a member of the Education Committee.

Keynote Speaker: Ron Hansell, Indianapolis

Fifty-two registered for the workshop.

at Cunningham, represented the State Board of Registration for Land Surveyors.

Rich Hudson, left and Tony Gregory from the Northwest's Chapter Committee.

CALENDAR

September 10, 1992
Northwest Chapter ISPLS meeting
September 24, 1992
Central Indiana Chapter meeting
October 2, 1992
ISPLS Workshop, McCormick's Creek, Topic: Indiana & ALTA/ACSM Land Title Surveys
October 15-16, 1992
Ohio Multi-Subject Fall Seminar, Holidome, Lima, OH, Boundary Location Principles, Rectangular Survey Systems, Business of Land Surveying, Storm Water Runoff Regulations, Surveying Measurements & Instrument Errors, Wetlands, & GPS. Contact Terry Hoppes, (513) 399-1532
September 24, 1992
Central Indiana Chapter Meeting
November 6-12, 1992
ACSM/GIS/LIS Fall Convention, San Jose, CA
November 12-14, 1992
Arkansas/Kansas/Missouri/Oklahoma Joint Conference. Springfield, Mo. Contract Sandra Boeckman, Exec. Dir. Phone: 314/635-9446
November 12-14, 1992
ASCE Specialty Conference on "Engineering Surveying for Megaprojects: with focus on the superconducting supercollider," Loews Anatole Hotel, Dallas, Texas.
November 18, 1992
Central Indiana Chapter ISPLS, Meeting
February 15-18, 1993
ACSM/ASPRS Annual Convention, New Orleans, Louisiana.
March 17-19, 1993
Joint Society Convention (ISPLS, ISPE, ASCE, CEI, IEEE), Adams Mark Hotel, Indianapolis
March 20, 1993
ISPLS Workshop, Adams Mark Hotel, Indianapolis, Indiana.

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