

Geospatial technology & its role in land surveying

—by Ann K. Deakin

The use of geospatial technology in the context of land surveying is the subject of intense, ongoing debate. A few surveyors believe that, in an effort to “safeguard life, health, and property, and to promote the public welfare,” the use of such technology should be in the hands of licensed surveyors only.

As a result, some states have expanded their definitions of the practice of land surveying to the point where, for example, the use of a GPS receiver to collect any locational information constitutes land surveying (Figure 1). Yet, this may not have been necessary.

While the technology has, in many ways, revolutionized the way land surveyors and others do their jobs, it hasn’t changed the legal requirements for certified survey products. Anyone can access the technology, but only licensed surveyors can make or document original measurements in the creation of certified survey products. In spite of this, the technology rather than the final product seems to remain the concern.

If geospatial technology is indeed the issue, where does it fit? Should the technology be the purview of one profession and regulated accordingly? Should it be available only to those licensed to use it regardless of profession? If it’s not, should geospatial technology be accessible by all and the regulations govern the output?

Perhaps the logical place to start is to review what constitutes geospatial technology, and how the technology has evolved.

Evolution of Geospatial Technology

Geospatial technology, now often referred to simply as “geospatial,” includes those technologies—such as GIS (Geographic Information Systems), GPS (Global Positioning Systems), and remote sensing—which support the identification and interpretation of geographic locations and the characteristics of those locations.

In this day and age, geospatial data are everywhere and accessible by everyone, as evidenced by the popularity of such programs as Google Earth and MapQuest. The ubiquity of GPS technology, alone, in the form of handheld recreational units, vehicle navigation systems, and cell phones would seem to provide anyone with the power to define space.

Ironically, the origin of much of the data obtained with GPS can probably be traced to someone who used traditional survey methods to document the locations of features being viewed on screens of varying sizes. As David Gibson (1999) observed, surveyed products are the basis for “geographic fidelity” in many geospatial databases.

Geospatial technology has been around in some form or other since the 1950s. There is evidence that the concept of GIS developed in a similar fashion in several locations over approximately the same time frame.

Rather than “who” or “where,” what is perhaps most interesting about the development of GIS is “why.” In most instances, the incubation of GIS was the need to solve

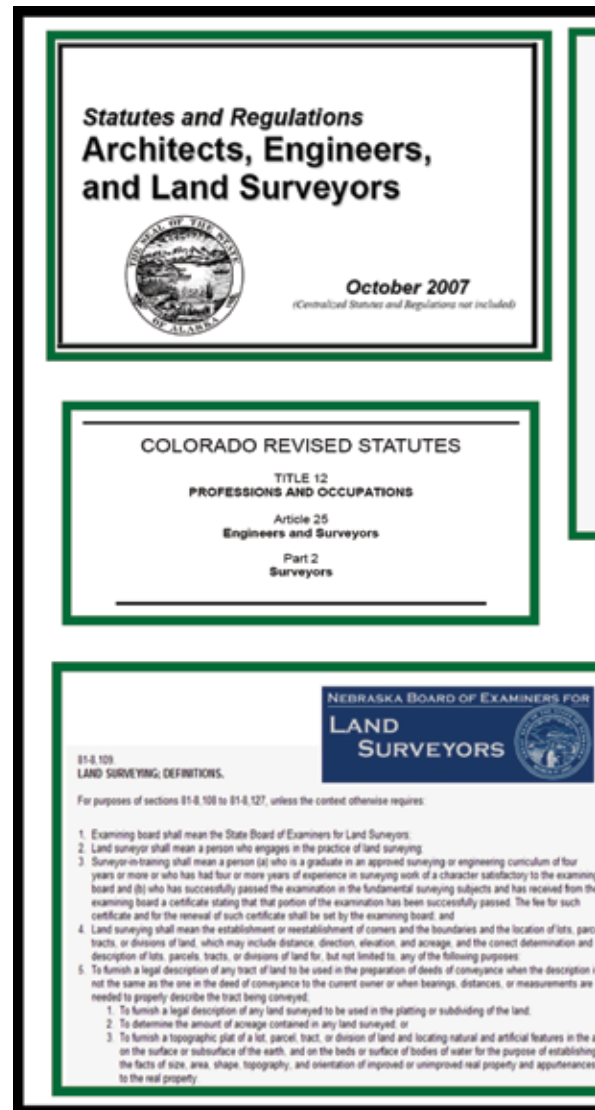


Figure 1. Statutes defining the practice of surveying.

a problem. With some variation, that problem was, to one extent or another, the need to analyze and manage an enormous quantity of data. (For a more detailed account of the history of GIS, the reader is encouraged to peruse books such as Foresman’s *The History of Geographic Information Systems: Perspectives from the Pioneers.*)



system to support precise weapons delivery, which would also support the needs of a broad range of users.

The GPS we know today dates to December 1973 when the DoD approved the Air Force's plan to develop NAVSTAR (NAVigation Signal Timing And Ranging) GPS. Full operational capability was achieved in 1995. Civilian use of GPS began well before 1995, led in large part by surveyors. The advent of GPS meant that surveyors now had a tool for achieving higher accuracy across greater distances where there was no line of sight between the points to be surveyed.

The surveying community's enthusiasm for GPS was reinforced as a result of NOAA's (National Oceanic and Atmospheric Administration) 1984 decision to approve the use of GPS data in mapping and geodesy (Parkinson 1994). It didn't take long for commercial GPS equipment designed for surveyors to appear on the market.

The equipment currently available is a far cry from the 17 pound, single frequency receivers of the 1980s (Figure 2). At that time, surveyors had to spend long periods of time in the field to make observations and, of course, long periods of time post-processing their observations back at the office.

Since the early 1990s, RTK (Real-Time Kinematic) GPS became commonplace, enabling surveyors to achieve centimeter-level accuracy with real-time corrections while on the move (Figure 3). RTK networks currently on the market have eliminated the need to set up a sepa-

rate base station to achieve RTK positions. One person can do the job by simply connecting to the network and begin measuring almost immediately.

While there are many advantages to incorporating GPS equipment into the surveying process, the technology does have some limitations. Survey-grade GPS equipment is still not as accurate as the total station or the steel chain, particularly over distances less than 1,500 feet. Furthermore, while GPS does not require line of sight between points, it does require a line of sight to as many satellites as possible. Tree cover, buildings, and other obstacles can block that line of sight. Even with a clear view of the sky and the horizon there may not always be enough satellites available in all locations at all times. It is precisely these limitations, though, which will continue to spur advancement in GPS technology. In addition to more access to more signal frequencies, the integration of inertial navigation systems may make signal obstruction a problem of the past.

Surveyors have always been on the leading edge of GPS. It's important to remember though, that embracing the technology does not mean that the technology defines the discipline.

Many professions have changed their methods with advances in technology, but these professions still provide the same fundamental services. A surgeon may be using minimally invasive techniques made possible by robot-

Perhaps not surprisingly that is precisely why many organizations turn to GIS today; fortunately, that concept and its supporting science and technology are now firmly in place and ready to be used.

The development of GPS was more directed—the U.S. Department of Defense (DoD) wanted a

ics, but the surgeon is still repairing a heart valve.

Part of being a professional is having the knowledge to apply the appropriate tool. Surveyors know that the centimeter-level accuracy achievable through RTK may not be good enough. The solution may require falling back on the total station or the steel chain.

Where Should the Focus Be?

If the technology isn't the issue, then, what is? The constant throughout the advancement of geospatial technology is the need for making or documenting original measurements in the creation of certified survey products. The focus should be on these final products.

Are the data to be provided to the public as a survey product? If the answer is yes, then clearly a licensed surveyor must, by state law, be part of the process resulting in that product. If the answer is no, then the licensed surveyor's time is better spent on another project.

An emphasis on the final product of a technological advance was the approach the NCEES (National Council of Examiners for Engineering and Surveying) took in the mid-1990s when it revised the Model¹ Law and its Model Rules (Figure 4).

The Model Rules provide specific inclusions and exclusions to the definitions in the Model Law. In the case of the definition of surveying, the Model Rules make it quite clear that it is the final product that determines whether specific activities are included or excluded.

"A distinction must be made in the use of electronic systems between making or documenting original mea-



Figure 2. Manpack Global GPS exhibited at National Museum of American History, Division of Medicine and Science [http://americanhistory.si.edu/collections/object.sfm?key=35&objkey=220].

surements in the creation of survey products, versus the copying, interpretation, or

If the NCEES has made it clear that it recommends an emphasis on the final product, why then are many states still focusing on the technology?

The continued assimilation of geospatial technology into the profession of surveying is coincident with a period of soul-searching on the part of some surveyors. For a vocal few, it is the perceived encroachment of geospatial technology that is threatening the profession.

In the June 2008 issue of Professional Surveyor Magazine, Tom Gibson posed a question: Do RTK systems reduce the number of surveyors required for a typical job? Rather than believing such

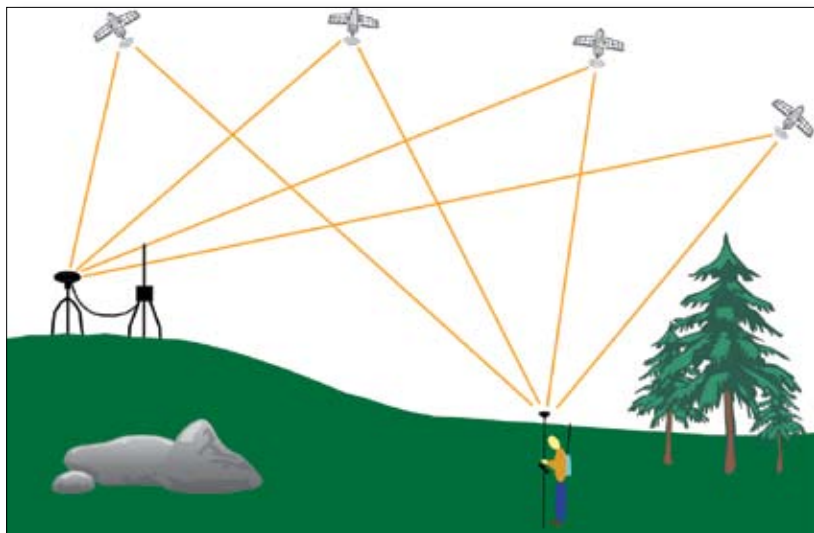


Figure 3. An RTK network implementation.

representation of those measurements in such systems" (NCEES 2007b, pp. 3-5).

Hence, according to this rule, maps and georeferenced databases that are provided as a survey product representing authoritative locations for boundaries, the location of fixed works, or topography are activities that must be conducted by a licensed surveyor.

technology to be a threat, the respondents saw it as a means for doing more work.

The reality is that the surveying profession, at an average age of 57 in 2006, is at a point where it needs to replenish its retiring ranks (Gibson 2007). Geospatial technology would appear to be a powerful recruiting tool, not the cause of an identity crisis.

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¹The NCEES Model Law is a reference for states preparing new proposed laws or amendments to existing legislation.

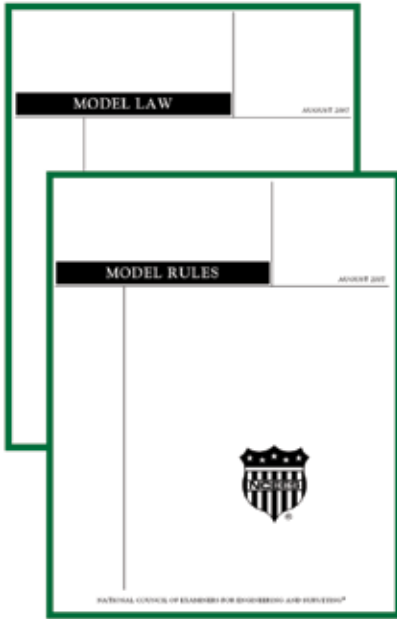


Figure 4. NCEES Model Law and Model Rules.

Surveyors were on the leading edge of GPS technology in the 1980s, and that leadership continues to be the case. The surveying community has, for example, used the relatively new civil code GPS signal on the L2 frequency (L2C) more than any other civilian profession (Fosburgh and Peetz 2004). Indeed, surveyors should perhaps be credited with making it clear that GPS is no longer a primarily military system.

Conclusions

Geospatial technology, while a powerful tool for many, does not a surveyor make. Indeed, there are many small surveying firms that continue to be successful without GPS equipment, not because they don't want to use it, but because it is prohibitively expensive.

Those who do use GPS and GIS routinely are, like all professionals, not satisfied to rely completely on new technology. They push the technology to its limits and fall back on tried and true methods when the technology fails to yield the necessary accuracy and precision.

As part of the larger process, geospatial technology deserves consideration and clarification, but it need not be demonized. The technology has been an accepted part of surveying for at least 25 years, and the need for licensed surveyors still hasn't changed. Geospatial technology is, in many cases, ancillary to the process; it merely facilitates progress toward the end product.

The ongoing debate over the use of geospatial technology in the context of land surveying is a reminder of the interdisciplinary nature of such technology. Various disciplines have made unique contributions to its evolution over the years and will continue to do so in the future.

Users of geospatial technology need to understand the fundamental value of survey-grade land bases as vital layers in many GISs and realize that the broadening of the civilian use of GPS is due in no small part to the activities of surveyors.

My experience in private industry in the late 1980s and early 1990s showed me that for many of our data

conversion clients a survey-grade land base was, if not required then certainly highly desirable. Depending on the project, GIS stood for "Get It Surveyed" in addition to "Geographic Information Systems."

The technology is making highly accurate survey-grade data more accessible, but it cannot replace the surveyors operating the technology. Thus, it always comes as a surprise to me that a few surveyors perceive geospatial technology as a threat or as something that must be corralled into a suite of services that only licensed surveyors can provide, regardless of the end product.

I would like to leave them with a thought: Geospatial technology does not define the surveying profession, but it can serve to heighten awareness of it through the increased availability of highly accurate geospatial databases.

Acknowledgements

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