

IISL-95-IISL.4.16

INTERNATIONAL ASTRONAUTICAL FEDERATION  
INTERNATIONAL SPACE LAW COLLOQUIUM

USE OF GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) EVIDENCE FOR  
LAND SURVEYS: LEGAL ACCEPTABILITY

by  
Paul B. Larsen\*)

INTRODUCTION

The purpose of this paper is to construct a lawyer's view of Global Navigation Satellite Systems (GNSS) by examining how a lawyer would work in court with evidence produced by the Global Positioning System (GPS). I will illustrate this by using land surveying as the example. Contracting parties and their lawyers have, for a long time, used surveys to describe property in deeds of conveyance and to prove to the courts the boundaries of property in court actions to enforce conveyances. The way lawyers use GPS-produced evidence in land surveying legal actions may be extended by analogy to other areas of the law, such as aviation litigation.

BACKGROUND

The Global Navigation Satellite System used for this analysis is the Global Positioning System operated jointly by the Department of Defense (DOD) and the Department of Transportation (DOT).

GPS consists of 24 satellites located in six orbital planes. GPS satellites operate in circular orbits at 20,200 km (10,900 nautical miles). The GPS satellites are spaced so that a minimum of five satellites are in view worldwide at all times. 1/ Positions are determined through GPS by finding the intersection of four separate vectors, each with a known origin and known magnitude. 2/ A single GPS receiver requires four simultaneous measurements from four satellites in order to determine position in three dimensions and time, (i.e. latitude, longitude, altitude and time). 3/

The GPS is a dual use (civilian and military) system and provides two levels of service. The Standard Positioning Service (SPS) is available to all users on a continuous worldwide basis free of charge. A second level of service, the Precise Positioning Service (PPS) is more accurate, but is

available only to military users. However, it is technically possible for the Standard Positioning Service to be augmented to provide greater accuracy. 4/ For example, the U.S. Federal Aviation Administration will establish the Wide Area Augmentation System (WAAS) for aviation and other high speed uses.

The more publicized use of GPS is for air, marine and land navigation. However, GPS also is available for purposes other than transportation such as meteorology, mapping, charting, geodesy, surveying, precise timing and development of geographic information systems. Surveying uses include densification control, corridor and project control, mapping, structure control, cadastral surveys and airborne GPS photogeometry control. 5/

Surveying and related uses frequently include: (1) surveying and site location (the 1994 Federal Radionavigation Plan reports that "surveyors routinely measure 5, 50, 500, and 5000 km baselines to centimeter accuracy in all components); (2) accurate timing of electronic systems; (3) support for meteorological analysis (for example by tracking weather radiosondes

carried by balloon); and (4) tracking of goods (for example, finding the location of shipping containers and trucks). 6/ GPS began to be used by the surveying community in the late 1970s as soon as a few GPS satellites were in orbit. The advantages in accuracy and cost became evident at once. Surveyors can obtain centimeter-level accuracy on long base lines of hundreds of kilometers. As the cost of GPS receivers declines, surveyors are discovering new GPS applications. Consequently ordinary surveying increasingly is being accomplished through GPS.

Looking just at surveying, use of GPS can

- (1) provide absolute geographic reference for latitude, longitude and altitude;
- (2) permit measurement of areas without triangulation;
- (3) facilitate prospecting for oil and minerals; and
- (4) support the National Spatial Data Infrastructure. 7/

Surveyors and mapping users "have combined GPS with computer databases, inertial navigation systems, digital imaging systems and, laser measuring systems." Thus by integration with

other technologies, precise positioning and timing information may be achieved. 8/

The U.S. Congress requested in the 1994 Defense Authorization Act a joint study of GPS technical and management issues by the National Academy of Sciences (under the auspices of the National Research Council) and the National Academy of Public Administration. (The joint study is hereinafter referred to as the NRC study). As to surveying, the NRC study reports that the "single most powerful feature related to GPS, which is not true of traditional mapping and surveying techniques, is that its use does not require a line of sight between adjacent surveying points. This factor is paramount in understanding the impact that GPS has had on the surveying and mapping communities." 9/ Elimination of line of sight leads to great cost saving and improved accuracy.

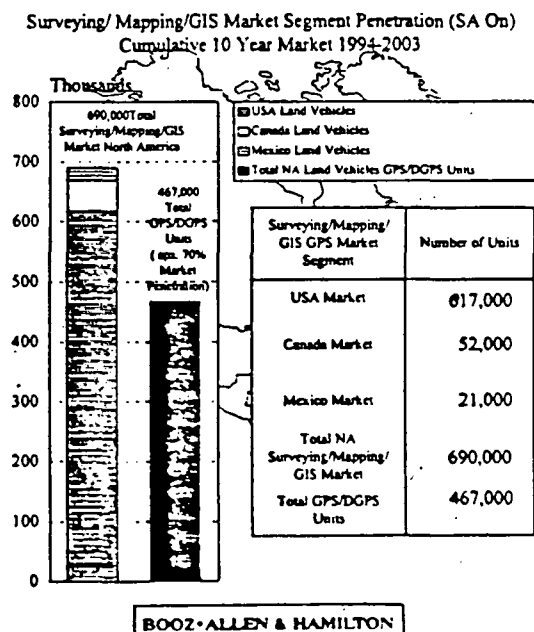
Another improvement in accuracy that GPS provides is to correctly assume the curvature of the earth. Traditional land surveying assumes that the earth is flat. 10/

The availability of accurate surveys through GPS is dramatically changing the surveying

business. For one thing, accurate surveys mean less waste of construction materials. In addition, labor cost and practices are changing because relatively low-paid technicians can now collect data in the field with GPS receivers, while the professional surveyors collect and apply the data in their offices. 11/ Not surprisingly, customers who now experience the benefits of highly accurate surveys tend not to be satisfied with the more approximate results of traditional land surveys. 12/ The National Research Council report projects the North American market for GPS surveying, mapping and geographic information as indicated in their chart reprinted below. However, GPS surveys probably will not dominate the market until the costs of receivers can be reduced.

### North American GPS Markets

*The surveying, mapping and GIS markets continue to enjoy the highest penetration percentages of all markets. GIS is only now beginning, with networks such as ACCQPOINT and DCI now available nationally.*



The benefits of GPS surveys are so profound that the NRC study's strong recommendation is to make the Defense Department's Precise Positioning System (PPS) available to all GPS users in order to promote the greatest possible accuracy in the profession. 13/

#### CONVEYANCING LAW

To be enforceable by a court in the United States a conveyance of land is required by the Statute of Frauds to be in writing. That means that the description of the land will be in writing. At common law written conveyances of land were by execution of deeds. 14/ A surveyor usually prepares the description of the property. In the United States there are several ways of describing property in deeds of conveyance. Property may be described by reference to a plat or map of land which has been subdivided into separate parcels. Property boundaries may also be described by courses and distances from a fixed monument. A course is the direction in which the survey line runs. There should be no ambiguity in the surveyor's description of the property which the deed purports to convey. Otherwise, the deed may be held to be invalid for insufficiency. 15/

At common law a certain amount of formality is attached to conveyancing property. For example the deed should be signed by the grantor of the property. A conveyance of land takes place upon delivery of the deed. In the United States formal recording of the deed (with the description of the property in the registry (Recorder's Office) is by most states considered to raise a presumption of valid delivery of the deed. 16/

#### LEGAL ACCEPTANCE OF GPS-GENERATED PROPERTY DESCRIPTIONS

Reliability is essential to sellers and buyers of property. Uncertainty in real estate transactions can invalidate the conveyance or have other negative legal consequences. Authentication of GPS-generated instruments of conveyance is one of the most significant legal concern. The question is whether courts will accept these conveyance instruments as valid evidence of the contract of conveyance. A useful legal analogy may be drawn between computer-generated data collection and GPS-generated data collection. 17/

a. Authentication of GPS-generated instruments of conveyance.

Legal authentication of data is the act of giving legal authority to a document, thereby making it admissible into evidence. Legal authentication also serves the purpose in commercial dealings of providing assurance to the parties to the conveyance that they are dealing with the correct property. 18/

The intention of the parties to a conveyance contract helps to identify the property. In other words, the legal validity of the conveyance contract is closely related and linked to the intention of the parties using the GPS-generated description of the property. 19/

By their signatures, the parties to the conveyance contract authenticate the document and the information contained within it. 20/ In the United States electronic-generated signatures are acceptable to validate a conveyancer instrument. That will not be true in all other countries.

In the United States, one of the factors that reflect on authentication is the in-court business records examination that is part of the law of evidence. The surveyor is proved to be licensed (and therefore reliable)

and the documents are proved to have been handled in an orderly, secure way. This is discussed more fully in the section that follows, but the point here is that in any country excellent organizational and operational security control will reflect well on the integrity of a property description.

b. Acceptance of GPS-generated conveyances as valid descriptive evidence of property being conveyed.

There is legal uncertainty about the use of GPS-generated evidence before courts and arbitral tribunals. It may be argued that data collection by use of GPS receivers and computers may not be safe from falsification.

Furthermore, it is conceivable that GPS-generated evidence may not be legally acceptable in some countries, although that is not the case in the United States. Thus the argument may arise that GPS-generated evidence should be rejected as valid evidence in case of litigation between the parties to a conveyance of property. 21/ In the United States and other countries that argument can be countered.

In United States courts, the original recording

must be used to prove the content of a document in Federal Court. Federal Rules of Evidence, Rule 1001(1), defines "recordings" as including magnetic impulses as well as electronic recordings or other forms of data compilation. Federal Rule 1001(3) describes an "Original" as "the writing or recording itself or any counterpart intended to have the same effect by a person executing or issuing it." The comments to Rule 1001 approve of computers and electronic recordings and appear to include them within the term "writing" thus making valid evidence of a printed form of the GPS-originated property description in the contract of conveyance. 22/

In litigation the lawyer must demonstrate the authentication of the GPS-originated property description; however, this does not require a witness to have personal knowledge of the manner of producing the property description. The lawyer may use circumstantial evidence to authenticate the property description by describing the manner and source of production of the description and proving that the genuine business records are stored in the appropriate Recorder's Office. 23/

U.S. Courts usually will admit business records as an exception to the

hearsay rule (prohibition of admission of hearsay evidence) if (a) the evidence consists of a record made in the regular course of business, at or near the time of the act, condition or event that it evidences; (b) a qualified witness testifies as to the identity and method of preparation of the document; and (c) the sources and time of preparation of the document indicate trustworthiness. Courts usually admit computer printouts under the business records exception and would likewise admit a printout of GPS-generated data as an exception to the hearsay rule. Thus the GPS-generated evidence will be let into evidence unless the opposing lawyer can prove its unreliability. 24/

In conclusion, it appears that the U.S. Federal Rules of Evidence permit the acceptance of GPS-generated property descriptions as evidence of the property being conveyed.

## CONCLUSION

My conclusions are based primarily on the U.S. law of land surveying. GPS-generated land descriptions generally are considered to be

authentic, thus establishing legal authority for documents based on GPS-originated evidence. GPS-originated land descriptions also provide legally satisfactory assurances to parties to a conveyance that they are dealing with the correct property. Finally GPS-generated evidence is legally acceptable in courts and other tribunals.

Legal acceptability of GPS-originated evidence for land survey would tend to indicate that GPS-originated evidence would be similarly acceptable in other areas of the law, for example as evidence of the location of a ship, airplane, or rail or motor vehicle at the time of an accident, or as used for the collection of accident or weather data.

#### FOOTNOTES

\* Georgetown University Law Center. The views expressed in this article are the author's and should not be attributed to any organization with which he is associated. Copyright 1995 by P.B. Larsen.

1. 1994 U.S. Federal Radionavigation Plan (FRP) at A-34. The FRP is published every two years

and states U.S. radionavigation policy. The 1994 FRP was published in 1995 and is an up-to-date statement of U.S. GPS policy.

2. 1994 FRP at A-35.

3. Id. at A-36. "Geodetic surveying measures the size, shape, and gravity field of the earth, and provides the control datums to which all other surveys are referenced. Surveying is also used to establish property boundaries, provide control points for large construction projects, support marine dredging operations and buoy placement, measure the physical dynamics of the earth's crust, map the relief and features of the earth's surface, and gather geospatial data (data with geographic coordinates)." Technical Report to the Secretary of Transportation on a National Approach to Augmented GPS Services, at 13.

4. 1994 FRP at 1-10, 1-11.

5. Id. at 2-5.

6. See Annex for chart regarding requirements for land use, surveying, timing and other applications, FRP art 2-34.

7. 1994 FRP at 3-33.

8. Joint study of GPS technical and management issues by the National Academy of Sciences (under the auspices of the National Research Council) and by the National Academy of Public Administration (hereinafter referred to as the NRC study), at 12.
9. NRC Study at 43.
10. Id. at 44.
11. Surveyor at 23.
12. NRC Study at 45-46.
13. Surveyor, vol. 14, no. 1, at 23.
14. Tiffany at 36 - 37.
15. Id. at 228.
16. Id. at 401.
17. The following discussion is substantially drawn from a paper by Larsen, McGill and Weber, Legal Aspects of Trade Data Interchange: Some Legal Aspects of Electronic Interchange of Trade Data, published by the U.N. Economic and Social Council, Economic Commission for Europe, TRADE/WP.4R.298/Rev.1, 6 Aug. 1984, (hereinafter cited as Larsen, McGill and Weber).
18. Id.
19. Id.
20. Id. at 7.
21. Id.
22. Id.
23. Id.
24. Id.