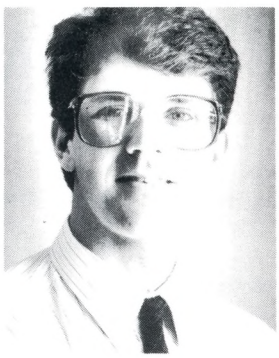
THE GEODESY CORNER

The Changing Form of Survey Positioning



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Before commencing this discussion of positioning as related to modern surveying, it is necessary to outline a few of the goals of this column.

First, since this "corner" proposes to deal with issues and technology that have traditionally been categorized as Geodesy, a definition is in order, and will follow.

Secondly, the articles to be presented here will not be fully technical in nature. The raison d'etre of these writings is to present ideas and advancements in "geodetic" surveying, in a readable fashion. Some of the discussion will naturally have technical content, but an attempt will be made to keep it straightforward.

Thirdly, and perhaps most important of all, the topics should hope to be interesting to surveyors from many different disciplines. This is especially true now that the Association of Ontario Land Surveyors has opened its membership to photogrammetrists, hydrographers and geodesists.

The realm of Geodesy is probably one of the most mysterious of all survey disciplines, due simply to the existence of many different interpretations and definitions of the term geodesy.

Each interpretation depends on the direction from which the subject is approached, and the era from which the definition is taken. In its broadest sense, geodesy is "the study of the measurement and portrayal of the earths surface". This was the definition given by Helmert in 1880.

In a more modern, structured context, geodesy is a combination of a number of disciplines, as defined in the text "Geodesy the Concepts". This particular book breaks geodesy down into three main categories:

a) positioning,
b) the earth's gravity field, and
c) temporal changes (crustal plate motion etc.).

Although a surveyor may have, has, or will have, a connection with all of these components, it is with the discipline of positioning that he/she is probably most familiar.

Whether the surveyor comes from a cadastral background, a control survey background, a hydrographic background or perhaps a research oriented background, they will be concerned with the position of an object or place at one time or another. This article looks briefly at the state of positioning today, with respect to the surveying community.

For the cadastral surveyor, positioning has principally involved the demarcation of boundaries and lot corners, and the location of features, both natural and man-made, with respect to the boundaries.

This positioning work is not all measurements and mathematics, and involves much legal interpretation and description.

In addition, much of the work is done within relatively small areas, and is often termed "plane surveying".

As a result, rigorous mathematical corrections that help model the earth's shape and characteristics are not often applied to the preliminary survey measurements. Instead, approximations are applied for earth curvature, refraction, and convergence of meridians.

Although these corrections suffice for most cadastral survey applications, much more rigorous and complex algorithms are needed when the survey area covers tens, hundreds and even thousands of square kilometres.

With the introduction of more sophisticated survey tools such as the Global Positioning System (GPS), and Geographic Information Systems (GIS), surveys will encompass larger and larger physical areas.

Consequently, the surveyor will need all the latest mathematical and analytical methods available to him/her. Combine this with the potential growth of integrated surveys, and one begins to see the extent of the expansion to the current bounds of cadastral survey positioning.

Cadastral surveying, control surveying (horizontal and vertical), hydrographic surveying, and photogrammetric surveying are undergoing revolutionary changes to the traditional scopes of their disciplines.

Positioning for control surveys once meant climbing to the top of the highest landforms in order to measure angles, and later, distances.

Now it is possible to position a survey station where it is most needed, not where it is most convenient. With the recent developments in kinematic GPS surveying, it is possible to position literally tens of control points per day in appropriate areas.

In hydrographic surveying, vessel positioning systems such as Loran C, Trisponder, Argo and Siledas are giving way to autonomous navigation and positioning methods using GPS.

These new methods allow vessels to move about more freely than before, and over much greater areas.

Aerial photography and the resultant mapping chores are becoming much more efficient through the use of accurate airborne positioning sensors, and fast, computerized digital mapping techniques.

Although all of the above advances have the Global Positioning System as a common link, it is the integration and application of available systems that will push the art of positioning to new heights. In addition, knowledge of the problem to be solved will become more important, and finding the best solution(s) to a positioning problem will differ depending on the intended result.

The surveyor who is performing first order control surveys will utilize systems and techniques that will give relative precisions on the order of 1:200,000.

A cadastral surveyor on the other hand, wants to be able to produce plots and descriptions to accuracies in the 1:10,000 - 1:20,000 range.

The offshore hydrographic surveyor may be seeking results in the 2-5 metre range, in the absolute position of the vessel.

In each of these situations, different combinations of positioning, computational and display techniques will be used to meet the requirements.

As the needs of both the public and the surveyor change, so too will the methods of survey positioning. With society becoming more and more concerned with "positional information", faster more economical surveys will evolve. In addition, methods of storing, retrieving and utilizing this survey data will become faster and easier to use

The traditional role of the surveyor as a person who can accurately determine the position of an object is still large, and now he/she can produce results with tools and techniques not dreamt of twenty years ago.

In the future, I will be writing in more detail about topics that contain the more "geodetical" aspects of surveying, including:

control surveys,
satellite positioning,
datum/ellipsoid relationships,
adjustments, and
other related fields.

Until next time - "Oblateness means never having to say you're 'round."