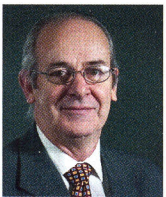


# Critical developments in land surveying

Does land surveying profession require a paradigm shift in identity to maintain its relevance?



**Brian J Coutts**  
School of Surveying,  
University of Otago,  
Dunedin, New Zealand



**Malcolm McCOY**  
Former President,  
Institution of Surveyors  
Australia (ISA)  
Vekta Pty Ltd, Australia

The methodologies of land surveying remained largely unchanged over hundreds, if not thousands, of years. Computational methods were enhanced with the use of logarithmic tables introduced by Napier in the 17<sup>th</sup> century, and supplemented by hand-powered rotational cylinder mechanisms for speed of calculation first introduced by Pascal, also in the 17<sup>th</sup> century. These were later to be electrified in the 20<sup>th</sup> century prior to the invention of the microprocessor, which introduced the electronic age in the 1970s. Advanced engineering allowed graduated circular scales to assist with angular measurement to a greater accuracy especially when in combination with a telescope, and linear measurement was carried out by using a variety of devices, often calibrated to a national standard, but the actual form used for a specific task was dependant on the accuracy required e.g. cloth tapes, steel bands. The invention of flight in the early 20<sup>th</sup> century allowed for photography to literally add a new dimension to the tools of the land surveyor.

## Technology

While the first electronic measurement using radio waves occurred in the mid 1950s, it was not until the 1970s that electronic distance measurement (EDM), with the likes of the Wild DI10 and the HP3800, came into everyday use. While the early EDM were large and cumbersome, they quickly became smaller to the point of fitting inside angle measurement equipment. Combining the optical theodolite with small EDM allowed electronic measurement to replace the more traditional means. Glass scales in theodolites were then replaced by bar code readers which then allowed angular measurement to be made by the instrument

itself, rather than requiring the operator to “read” the angular measurements. The integration of calculation into the electronics of the “total station” enabled direct read-out of “reduced” measurements, either horizontal, vertical or slope, and leading quite naturally to the data recorder.

Miniaturisation, starting with the invention of the transistor, also brought electronic calculators that could replace natural and logarithmic tables, and extended battery life allowed them to quickly replace mechanical calculators and books of natural and logarithmic tables, even in the field. At much the same time larger punch-card fed desktop computers were replacing the need for much of the time spent doing lengthy calculations in the office. Punch cards were replaced by magnetic strips, much simplifying the process again through the 1970s. However, further advances in miniaturisation made sizeable desk-top computers obsolete quite quickly, as hand-held calculators increased in power and capacity, as well as reducing in price.

Aerial photography developed in close association with the development of aircraft in the early 20<sup>th</sup> century and was an important aspect of the developing practice of airborne warfare. First used for reconnaissance purposes it quickly became an essential tool of warfare, and developed into the discipline of photogrammetry using stereoscopic images taken with precision cameras allowing the making of maps to be revolutionised. With the advance of satellite science since the late 1950s, the ability to gather data without the use of on-the-ground measurement has again changed the way in which maps are made using remote sensing technologies. Not only has the practice changed, but the uses to which remotely gathered information can be put have burgeoned.

Finding one's location on the planet was a considerable challenge to navigators until the invention of an accurate maritime clock by Harrison in the 1770s. The ability to establish accurate longitude enabled exploration in any part of the globe and brought accuracy to not only navigation but also to the mapping and charting of the newly discovered lands and seas. The reliance on accurate time for position finding has only diminished with the use of satellite positioning and the now ubiquitous use of global positioning systems (GPS) throughout the population along with its multifarious applications.

In the late 1970s the first desktop computers started to appear. Initially they were mainly used for word processing and spreadsheets, but other applications soon started appearing that were relevant to surveyors – there are now many surveying related software packages which are used and are compatible with the latest total stations and GPS equipment.

This new era of digitisation also saw the emergence of printers and plotting

devices which ultimately have replaced hand drafting which had formed part of the specialist skills of surveyors for hundreds of years. With the advent of AutoCad, Microstation and other CAD packages, hand drafting has now gone the way of the blacksmith – used seldomly by a few specialised practitioners.

Traditional cadastral, or property maps, which had been used for tenure and taxation purposes for hundreds of years became electronic in the 1980s with the advent of Digital Cadastral Data Bases (DCDB) or Digital Property Maps. Finally, Google Maps and Google Earth have now put digital maps and digital aerial photography in the hands of everyone who has a computer, a mobile phone, a tablet or an iPod.

### Government surveying

European settlement commenced in Australia and New Zealand in the early 1800s and this necessitated the “opening up of the land” by alienation of land from the Crown to private individuals. Accordingly,

one of the first and most important establishments was a Lands Department and the appointments in these new territories or colonies of Surveyors – General. By the late 1880s the Torrens System of land registration had been established and subdividing “Crown land” on behalf of the government was under way. (Similar stories can be told in other parts of the world which were being colonised at this time) This continued right through until the Second World War, at which time there was an rapid expansion in surveying in these jurisdictions due to vast post war immigration. As a consequence, a vast expansion of these countries infrastructure, namely roads, rail, water, and electricity and gas networks was undertaken. New government or quasi government departments were established and the surveying sections were an integral part of the new order.

However by the mid 1980s much of the major infrastructure had been established and these departments moved into maintenance phases rather than capital expenditure and subsequently we have seen a decline or in some cases the abandonment



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