LAND SURVEYING EDUCATION IN THE 21ST CENTURY

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ABOUT THIS PRESENTATION

- Education of the next generations of professionals in our field
- Background, issues, problems, directions in the profession
  - Possibilities, choices, possible consequences
- Background, issues, problems, directions in education
  - Possibilities, choices, possible consequences
A SURVEYING REVOLUTION...

- Consider a time before some major changes occur in surveying:
  - How do you, as an established surveyor, deal with rapid and unprecedented change?
  - How do you deal with changes to your whole world as a consequence of these changes?
IT IS THE YEAR 1550...

- The most powerful surveying instrument is the groma.
- Topographic mapping and simple property surveys are the height of surveying, plus a little construction.
- The limits of math needed are basic arithmetic, and more artistic skills are required for map drawing.
- There aren’t many surveyors about.
- This has been the state of surveying since Roman times.
IT IS THE YEAR 1650...

The previous 100 years have seen the introduction of:

- Plane table
- Theodolite
- Triangulation
- Trig. tables
- Logarithms
- Co-ordinates
- Vernier
- Telescope
- Slide rule
- Micrometer
- Barometer
- Graphite pencil
- Analytical Geometry
- Mercator’s Projection
- ...and the dreaded surveying textbook!
IT IS THE YEAR 1650...

- Surveying is now very mathematical — trigonometry is essential knowledge
- Small, local surveys are small business — geodesy is big and surveyors are now Earth measurers (géomètres)
- Triangulation knits together regions, nations and continents — no survey needs to be isolated
- Mapping is now precise and navigation much simpler and more reliable — a sea-based empire is possible
IT IS THE YEAR 1650...

- Calculus is still almost 50 years away...
- Clocks good enough for longitude determination (and erasers) are still 130 years away...
- Least squares and meters are still 150 years away...
- Photogrammetry and telegraphy are still 200 years away...
- EDM is still 300 years away...
- GPS is still 340 years away...
CONTRAST...

- Surveyors in 1550 with surveyors in 1650
  - Their education, their mindset, their worldview
- The role of surveying in the world in 1550 with its role in 1650
  - From village-based to planet-oriented
  - From drawing-based to measurement-focused
- Surveying was part of the scientific revolution
IT IS THE YEAR 2020...

- A client calls…
IT IS THE YEAR 2020...

- That survey’s done! What’s the next job?
IT IS THE YEAR 2009…

- USDA Natural Resources and Conservation Service aims to get a 1 m to 1.5 m DEM of all of Wyoming
  - For $95 per square mile, using LIDAR
- Well over 10 million vehicle GPS navigation systems
- Even more handheld GPS devices, including phones
  - Apple sold 4.3 million G3 iPhones last quarter
- 30+ million digital cameras sold per year
Vehicle-based scanning system using 6 lasers collects 1.5 million points per second.

Lidar collects 10,000 to 40,000 points per second, and 200,000 to 400,000 points per square mile, i.e., a square mile every 5 to 40 seconds at 10 ft spacing, with 4” to 6” vertical precision, for $100 to $800 per square mile.

Digital photogrammetry can produce well over 1,000 points/minute at centimeter-level precision.
IT IS THE YEAR 2009...

- Airborne scanners are producing more precise digital maps than aerial film cameras, e.g., Leica ADS40
- Terabyte drives are the norm for newer technologies doing field data collection
- The point cloud is the data set
- ‘Cloud computing’ is the computing and storage system
IT IS THE YEAR 2009...

- Measurement is becoming ubiquitous and almost free
- GPS embedded in all manner of mobile devices
- Cameras embedded in all manner of mobile devices
- Scanners, fluxgate compasses, inclinometers: shrinking
- Mobile computational power and digital data storage now almost infinite through cloud computing
IT IS THE YEAR 2009...

- Who has ‘control’ of spatial measurement?
  - Everyone … and no-one
- What does ‘control’ mean?
- Does ‘control’ matter?
- Ubiquitous spatial measurement capability means lower demand for professional services and less recognition of specialist skills
“Social relations are closely bound up with productive forces. In acquiring new productive forces, men change their mode of production; and in changing their mode of production, in changing their way of earning their living, they change all their social relations.”

Karl Marx, 1846
“We are the measurement experts”

- This is a dead-end as a professional model
- This is a dead-end as an educational model
EMPLOYMENT TRENDS

- As an employer, the information sector of the economy peaked in the 1980s
- Criteria for entry to the information sector keep getting higher, more expensive, more stringent
- Lower-skills jobs disappearing
- Job requirements keep expanding as technological change gets faster
- Information collection, manipulation, management and dissemination are becoming ubiquitous
Where in the information cycle should you be working?

What skills will you need to work there?
STORY TIME...
AND THE MORAL IS...

- Solve clients’ problems, don’t just give them a map (data and measurements)
- Move into the clients’ knowledge domain to understand their real needs and to adapt (engineer) your information to their needs
- Multi-disciplinary teams and skills are required
We are our information products
Surveying is an information industry

- Employment levels are falling
- Entry-level requirements are rising
- Job requirements are expanding
- Adding value to data is profitable, measuring it isn’t
- Will surveying be part of the information revolution?
EDUCATION ISSUES

- US Surveying programs all at state universities
  - State universities are short on funds!
  - Little imagination in fund-raising
- Surveying programs are not always popular
  - Low enrollment
  - Low research income
  - High costs
EDUCATION ISSUES

- Few US surveyors with PhDs to become faculty
- Generalists vs Specialists
  - Program splits: Maine, Florida, OSU
- Silos of expertise, e.g., CaGIS leaving ACSM
- No MS/PhD programs for surveyors, only specialists
- Many faculty are from overseas (at least 10 in major US programs, nearly all PhDs)
EDUCATION ISSUES

- Students no longer are truly full-time; most work
- Individualized programs are the norm
- Distance education is increasing rapidly
- Rush to graduate so can work and pay off loans
  - Short-change the future to get through the present
EDUCATION ISSUES

- The decreasing importance of measurement brings into question the role of technicians and 2-year programs in the long-term.
- The roles of cloud computing and distance education raise the question of where information processing and education take place.
- Off-shoring, anyone?
RECRUITMENT ISSUES

- Poor ‘brand recognition’ for surveying
- Deep confusion in the surveying profession over why the profession exists
- The US has no Len Beadell
- US surveying has no-one like James Herriot, no equivalent to legal and medical dramas on TV
RECRUITMENT ISSUES

- Role model problems:
  - Very few female students (50% of population)
  - Very few minority students (30+% of population)
  - Very few dyslexic students (up to 20% of population)
- We are ignoring most of the potential student pool
- We get proportionally fewer of the ‘best and brightest’
DEFINITION ISSUES

“The meaning of ‘knowing’ has shifted from being able to remember and repeat information to being able to find and use it.”  Herbert Simon (1996)

- ABET Accreditation focuses on ‘find and use’
- NCEES Examinations focus on ‘remember and repeat’
- Which model represents surveying, now and in the future? What and how do we ‘know’?
WHAT IS A PROFESSION?

Professions involve:

- Systematized theoretical knowledge and demonstrated proficiency, based on extensive education
- Ethical standards
- Professional closure (restricted entry)
- Indeterminacy of knowledge, based on experience
- Public service and altruism
WHAT IS TO BE DONE

- We have major choices ahead of us as a profession and as educators.
- Neither group can really go it alone to create a future.
- If we can’t agree on what the profession is about, we can’t educate the next generation of professionals.
- If we can’t agree on where we are going, we’ll end up somewhere else.
SKILLS REQUIRED IN 40 YEARS

- Learning these is the goal of a professional education
- Fundamental understanding of the processes by which one’s profession operates
- Understanding of decision-making process, and how to support them with spatial information
- Understanding how other people use spatial information
COLLEGE EDUCATION

- Focus on theory (15–20 year half-life) ahead of technology and techniques (5–7 year half-life)
- Focus on professional skills ahead of technical skills
- Focus on problem-solving and decision-making
- Focus on over-arching concepts ahead of disconnected detail
- Focus on breadth and possibilities, rather than one prescribed path
AFTER COLLEGE...

- College is a step, not a goal
- A professional requires relevant experience:
  - Create a professional experience curriculum
  - Formal training agreements
- Continuing education, using college resources
- Lifelong learning
Good luck in the future!
Thank you for your attention!