Surveying Body of Knowledge

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Why body of knowledge

The definition of a profession:

A profession is an occupation, vocation or career where specialized knowledge of a subject, field, or science is applied. It is usually applied to occupations that involve prolonged academic training and a formal qualification. It is axiomatic that *"professional activity involves systematic knowledge and proficiency."* Professions are usually regulated by professional bodies that may set examinations of competence, act as a licensing authority for practitioners, and enforce adherence to an ethical code of practice.

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Why body of knowledge

Internal reasons:

- To formulate the scope of the profession
- To enable the recognition for the need for college education
- To help surveyors in business development
- To develop surveying scholarship

External reasons:

- To help promote the profession
- To define the distinctiveness of the profession

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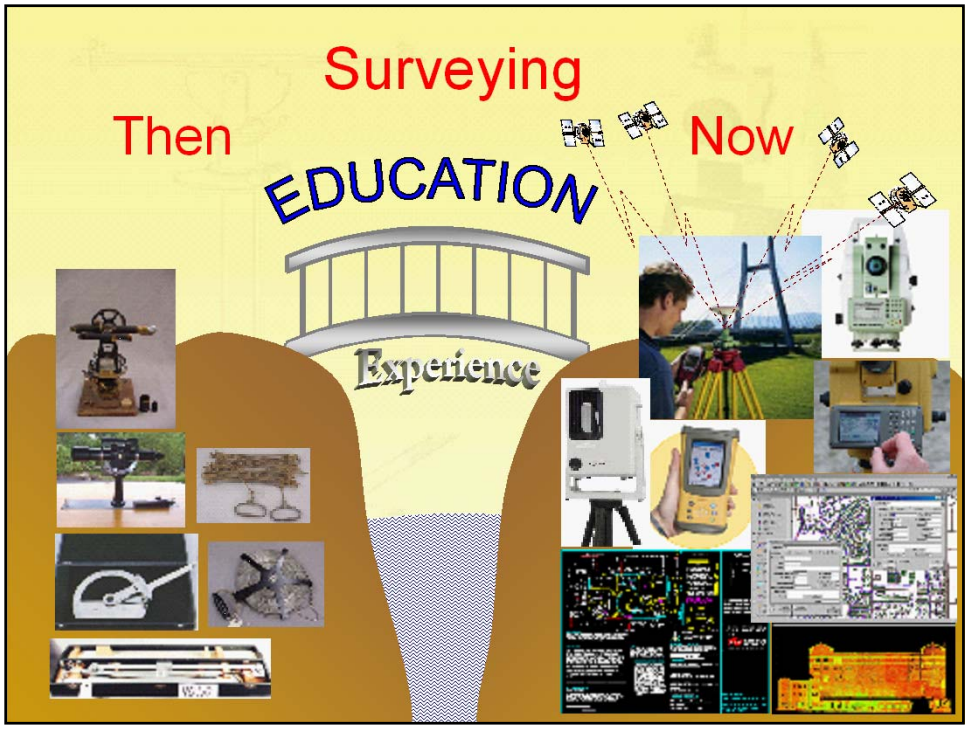

Approaches to developing a body of knowledge

- Macro level
- Micro level
- Technology centered
- Theory and science centered
- Knowledge vs. skills
- A combinations of the above

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Knowledge vs. Skills

Knowledge is knowing *what*, and *why*.

- It's about knowing the concepts, the terminology.
- Ability to use concepts from one field to another, to spot patterns between things.

Skill is about knowing *how* and being useful

- it's *only* about being able to do things
- Not about knowing *why* things are as they are or *what* exactly they are. It's just that you can do it

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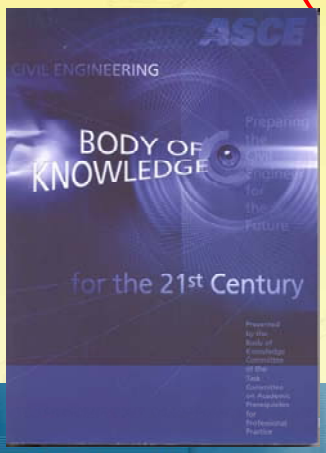
Resources for Body of Knowledge (BoK)



ABET
Leadership and Quality Assurance in Applied Science, Computing, Engineering, and Technology Education

National Council of Examiners for Engineering and Surveying

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The Macro Level Surveying Body of Knowledge

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Macro Level Overview

- A technical core of knowledge and breadth of coverage in mathematics, science, and technology.
- Law, ethics and professionalism
- Communication, history, social science and contemporary issues
- Business, economics, management
- At least one in-depth specialty in surveying law, geodesy, GIS, image based mapping, or other.

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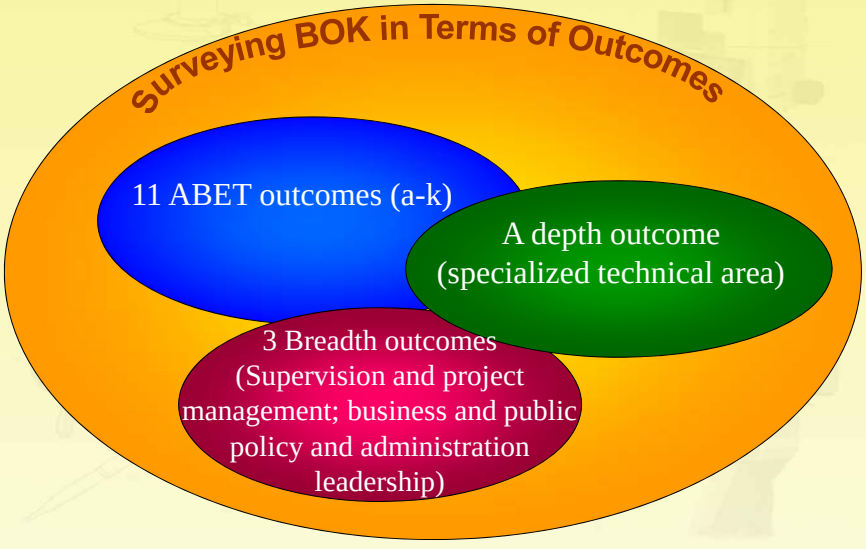
The 15 BoK Outcomes



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The 21st Century surveyor must demonstrate:

1. **an ability to apply knowledge of** mathematics, science and engineering/applied science/ technology. (ABET (a))

2. an ability to design and conduct **experiments,** as well as **analyze** and **interpret** data. (ABET (b))

3. an ability to **design** a system, component, or process to meet desired needs. (ABET (c))

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The 21st Century surveyor must demonstrate:

4. an ability to function on **multi-disciplinary teams.** (ABET (d))

5. an ability to identify, formulate and solve **Surveying problems.** (ABET e)

6. an understanding of **professional and ethical responsibility.** (ABET (f))

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The 21st Century surveyor must demonstrate:

7. an ability to **communicate** effectively. (ABET (g))

8. a broad education necessary to understand the **impact of Surveying solutions** in a global and societal context. (ABET (h))

9. a recognition of the need for, and an ability to engage in, **life-long learning.** (ABET (i))

The 21st Century surveyor must demonstrate:

10. a knowledge of **contemporary issues.** (ABET (j))

11. an ability to use the techniques, skills, and modern **Surveying tools** necessary for surveying (engineering) practice. (ABET (k))

12. an ability to apply knowledge in a **specialized area related to Surveying**

The 21st Century surveyor must demonstrate:

13. an understanding of the elements of **supervision and project management**

14. an understanding of **business and public policy and administration fundamentals**

15. an understanding of the **role of the leader** and **leadership principles**

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The Micro Level Surveying Body of Knowledge

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FIG Definition of the Functions of the Surveyor
1. Th deter ation of the size and shape of the earth and t ea ment of all data needed to define th size, har d contour of any part of the ear change therein.
2. The positioning time as well as the positioning features, structur nd e above or below the surface
3. The development, testing and calibration sens instruments and systems for the above-mentioned purposes and for other surveying purposes.
POSITIONING
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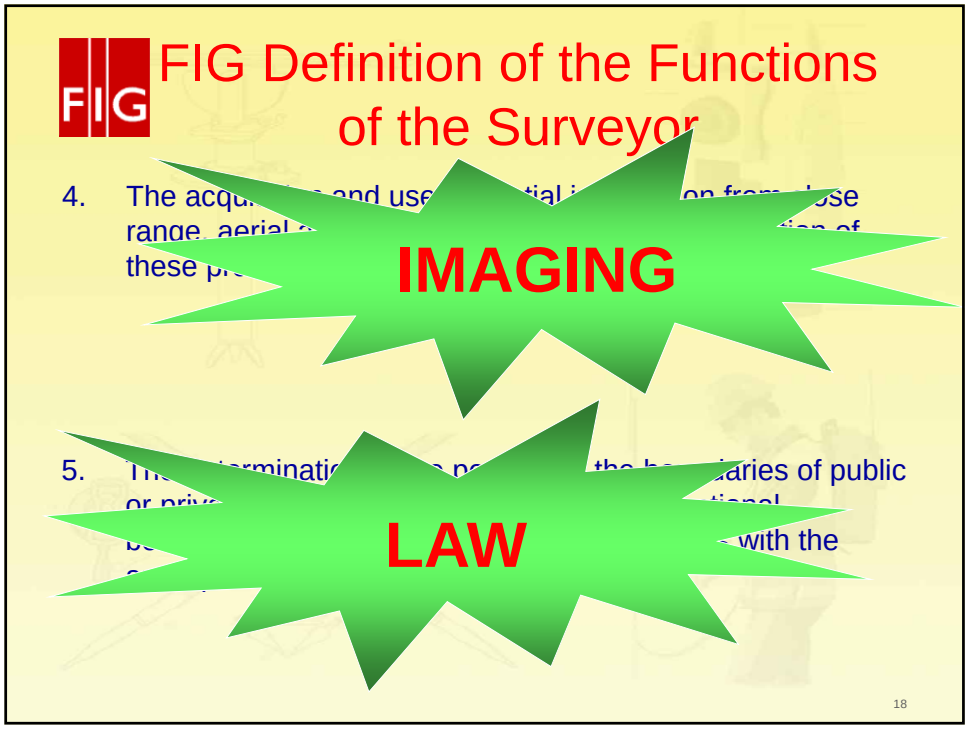
FIG Definition of the Functions of the Surveyor
4. The acqu and use tial i on from ose range, aerial tion of these pr
5. Th rminatio the b aries of public or priv tional b with the
IMAGING
LAW
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FIG Definition of the Functions of the Surveyor

6. The design, establishment and administration of geographic information systems (GIS) and the collection, storage, analysis, management, display and dissemination of data.

7. The analysis, interpretation and integration of spatial objects and phenomena in GIS, including the visualisation and communication of such data in maps, models and mobile digital devices

GIS

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FIG Definition of the Functions of the Surveyor

8. The study of the natural and social environment, the measurement of land and marine resources and the use of such data in the planning of development in urban, rural and regional areas.

9. The planning, development and redevelopment of property, whether urban or rural and whether land or buildings.

10. The assessment of property, buildings.

Land Development

11. The planning, management of construction works, including estimation of costs.

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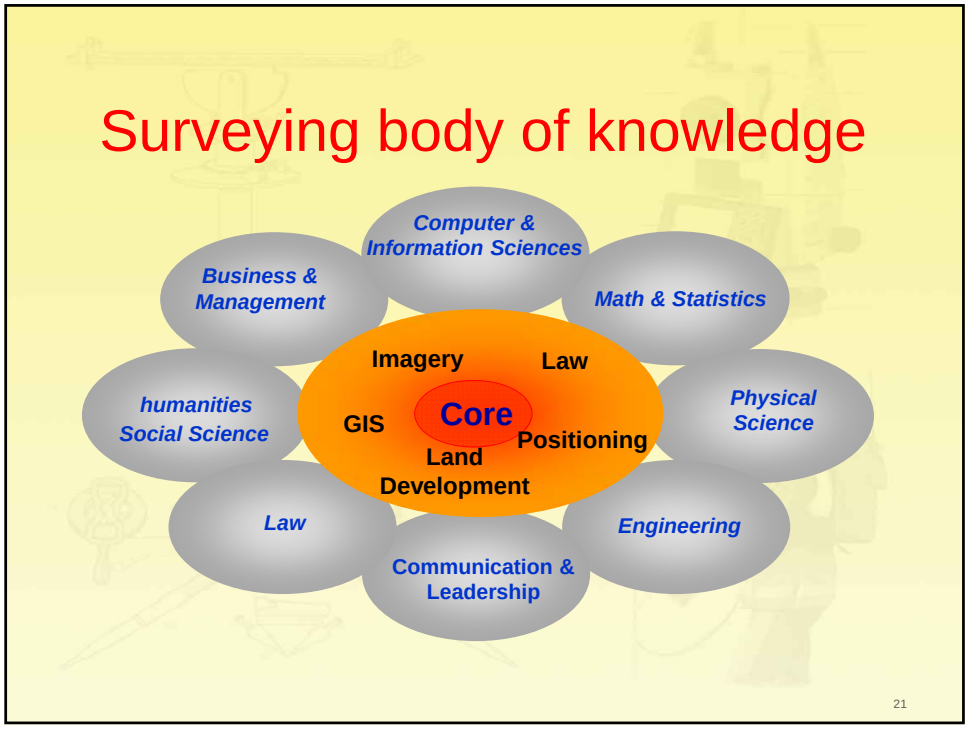
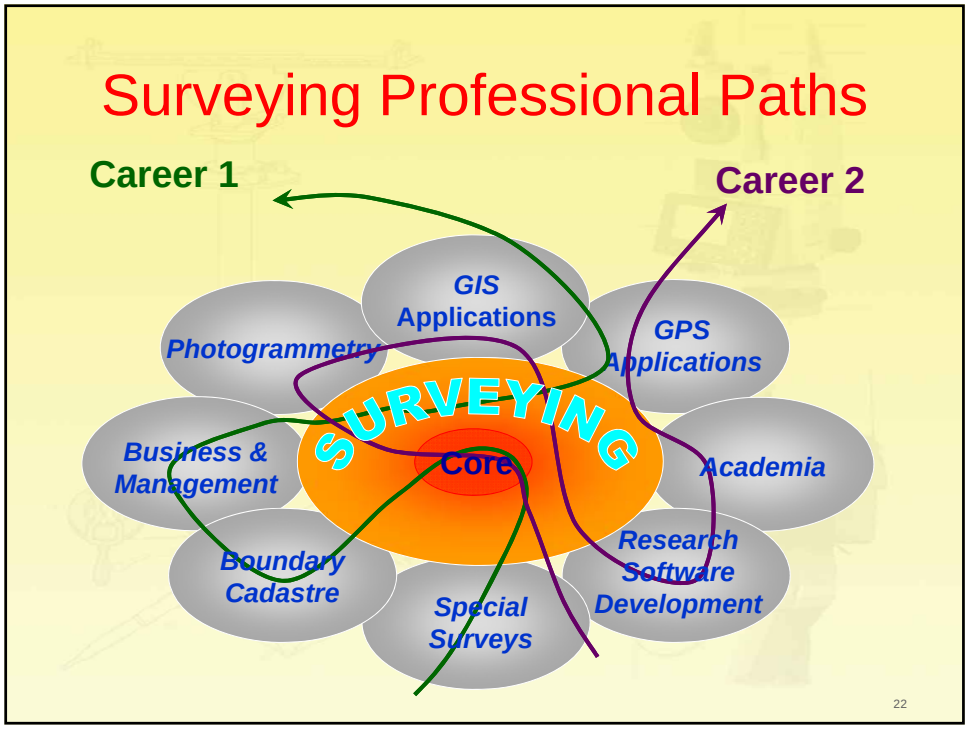

Surveying body of knowledge
Computer & Information Sciences
Business & Management
Math & Statistics
humanities Social Science
Physical Science
Law
Engineering
Communication & Leadership
Imagery
Law
GIS
Core
Positioning
Land Development
21


Surveying Professional Paths
Career 1
Career 2
GIS Applications
Photogrammetry
GPS Applications
SURVEYING
Core
Business & Management
Academia
Boundary Cadastre
Research Software Development
Special Surveys
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Three Suggested Roles Played by Surveyors in GIS&T

Category	Level of involvement
User	Routine use of basic GIS technology
Specialist	GIS application design and development
Scholar	GIS research and development

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Levels of competencies

(Greenfeld (et. al, 2008)

- ***Recognition*** represents a reasonable level of familiarity with a concept but lacks the knowledge to specify and procure solutions without additional expertise.
- ***Understanding*** implies a thorough mental grasp and comprehension of a concept or topic. Understanding typically requires more than abstract knowledge.
- ***Ability*** is a capability to perform with competence. As one grows professionally, his/her abilities also develop so that more challenging and difficult problems can be solved.

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GIS BoK for Surveying

Knowledge Area: Analytical Methods (AM)

	user	specialist	Scholar
Query operations and query languages	U	A	A
Geometric measures	A	A	A
Basic analytical operations	A	A	A
Basic analytical methods	A	A	A
Analysis of surfaces	A	A	A
Spatial statistics	U	U	A
Geostatistics	R	U	A
Spatial regression and econometrics	R	R	R
Data mining		R	U
Network analysis		U	U
Optimization and location-allocation modeling		R	A

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GIS BoK for Surveying

Knowledge Area: Conceptual Foundations (CF)

	user	specialist	Scholar
Philosophical foundations	U	U	A
Cognitive and social foundations	R	U	R
Domains of geographic information	U	A	A
Elements of geographic information	A	A	A
Relationships	U	A	A
Imperfections in geographic information	U	A	A

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GIS BoK for Surveying

Knowledge Area: Cartography and Visualization (CV)

	user	specialist	Scholar
History and trends	A	A	A
Data considerations	U	A	A
Principles of map design	A	A	A
Graphic representation techniques	A	A	A
Map production	U	A	U
Map use and evaluation	A	A	A

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GIS BoK for Surveying

Knowledge Area: Design Aspects (DA)

	user	specialist	Scholar
The scope of GIS&T	U	A	A
system design	R	A	A
Project definition	R	A	A
Resource planning	R	A	A
Database design		A	A
Analysis design		A	A
Application design		A	A
System implementation		A	A

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GIS BoK for Surveying

Knowledge Area: Data Modeling (DM)

	user	specialist	Scholar
Basic storage and retrieval structures	A	A	A
Database management systems	U	A	A
Tessellation data models	R	U	A
Vector and object data models	A	A	A
Modeling 3D, temporal, and uncertain phenomena	R	U	A

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GIS BoK for Surveying

Knowledge Area: Data Manipulation (DN)

	user	specialist	Scholar
Representation transformation	A	A	A
Generalization and aggregation	R	U	A
Transaction management of geospatial data	R	R	A

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GIS BoK for Surveying

Knowledge Area: Geocomputation (GC)

	user	specialist	Scholar
Emergence of geocomputation	R	U	A
Computational aspects and neurocomputing			A
Cellular Automata (CA) models			A
Heuristics			A
Genetic algorithms (GA)			A
Agent-based models			A
Simulation modeling			A
Uncertainty		R	A
Fuzzy sets			A

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GIS BoK for Surveying

Knowledge Area: Geospatial Data (GD)

	user	specialist	Scholar
Earth geometry	A	A	A
Land partitioning systems	A	A	A
Georeferencing systems	A	A	A
Datums	A	A	A
Map projections	A	A	A
Data quality	A	A	A
Land surveying and GPS	A	A	A
Digitizing	A	A	A
Field data collection	A	A	A
Aerial imaging and photogrammetry	A	A	A
Satellite and shipboard remote sensing	A	A	A
Metadata, standards, and infrastructures	U	A	A

GIS BoK for Surveying

Knowledge Area: GIS&T and Society (GS)

	user	specialist	Scholar
Legal aspects	A	A	U
Economic aspects	R	U	U
Use of geospatial information in the public sector	R	U	U
Geospatial information as property	A	A	U
Dissemination of geospatial information	U	A	U
Ethical aspects of geospatial information and technology	R	A	U
Critical GIS			U

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GIS BoK for Surveying

Knowledge Area: Organizational and Institutional Aspects (OI)

	user	specialist	Scholar
Origins of GIS&T	R	U	U
Managing GIS operations and infrastructure	R	A	U
Organizational structures and procedures		A	U
GIS&T workforce themes		U	R
Institutional and inter-institutional aspects		A	R
Coordinating organizations (national and international)		A	

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GIS Education for surveyors

	Undergraduate Degree	Professional Education	Post-graduate Certification	Graduate degree
Routine user	***R***	***R***	***P***	**-**
Specialist	***R***	***R***	***R***	***P***
Scholar	***R***	***P***	***P***	***R***

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What's next?

- Receive feedback on the body of knowledge findings
- Streamline all five parts of the body of knowledge to a consistent document
- Lobby national and state societies to adopt and implement the body of knowledge.

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If you are interested in becoming involved send an email to:

greenfel@njit.edu

A four hour workshop with details on the body of knowledge will be presented in 2 weeks in Phoenix AZ at the ACSM-GITA conference

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The body of knowledge committee

Members:

- Josh Greenfeld, PhD, LS – Committee chair
- Bob Burtch, PS, PE – Ferris State University
- Earl Burkholder, PS, PE – NM State University
- Bob Dahn, PLS – Private practice
- Wendy Lathrop, PLS – Private practice
- Joe Paiva, PhD, PLS – Geomatics Consultant

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