Cartographic and Geospatial Futures

1. **Web Cartography , WebGIS, & Virtual Globes--New Roles for Maps, GIS, and GIS professionals**
2. **Map Mashups, the Neo Neo-geography Movement, & Crowd-sourcing Geospatial Information**
3. **Experiments in Visualization**
4. **Mobile Mapping and GIS**
5. **Ubiquitous/Pervasive Computing**
6. **Data Mining and Knowledge Discovery**
7. **Emerging Ethical Issues**
8. **New Tools, New Skills Needed**
9. **Education and Training--CU and elsewhere**
10. **Trends of Innovation: Barriers and Constraints to Change**

Map Mashups, the "Neo" Neo-geography Movement , Crowd-sourced, & Volunteered Geospatial Information

Google Earth and other systems are now opening their interfaces to others using, as much as possible, open standards

Map mashups are now easy to create and share

The Rise of a New "Neo-geography"

Neogeography literally means "new geography", and is commonly applied to the usage of geographical techniques and tools used for personal and community activities or for utilization by a non-expert group of users[1] Application domains of neogeography are typically not formal or analytical. **(Wikipedia)**

For examples, search the web:

WikiMapia.org

http://www.openstreetmap.org/

Experiments in Visualization: Animation, Virtual Reality, 3D,

These innovations represent the use of an expanded range of visual resources, as well as audio, video, hypermedia.

Compare Bertin's visual variables to those outlined by Petersen for animation, or those available with audio and video technologies

Peterson, M.P, Between Reality and Abstraction: Non-Temporal Applications of Cartographic Animation, http://maps.unomaha.edu/AnimArt/article.html

A. Digital atlas projects

- **U.S. National Atlas**
- **Canadian National Atlas**

B. CD atlases

- **Atlas of Oregon**
- **National Geographic, and others**
- **Flight atlases**

VRML & X3D

X3D examples

http://www.web3d.org/x3d/content/examples/Basic/index.html

Google's Sketchup

http://sketchup.google.com/

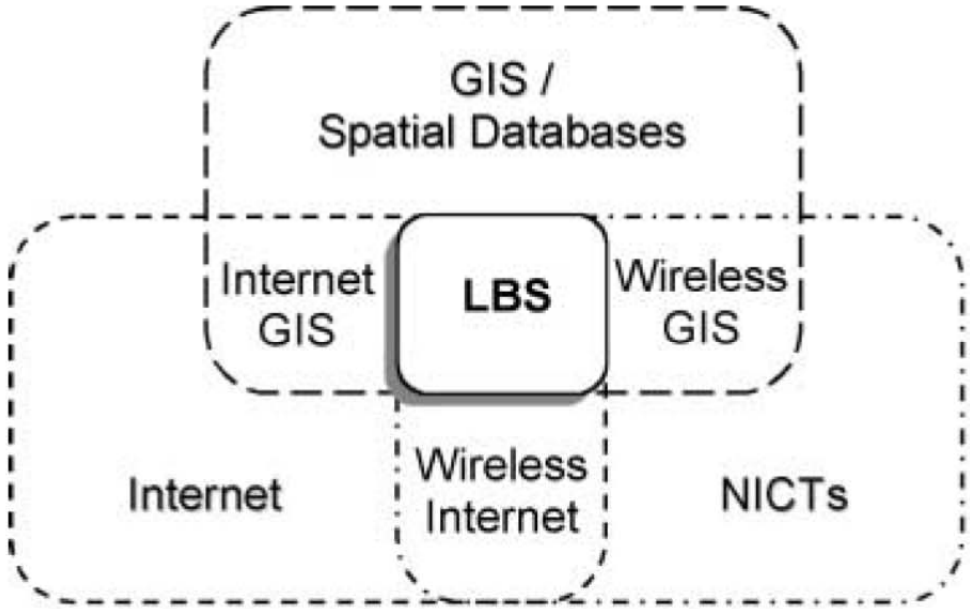


Figure 1 The technological niche of LBS (from Brimicombe 2006)

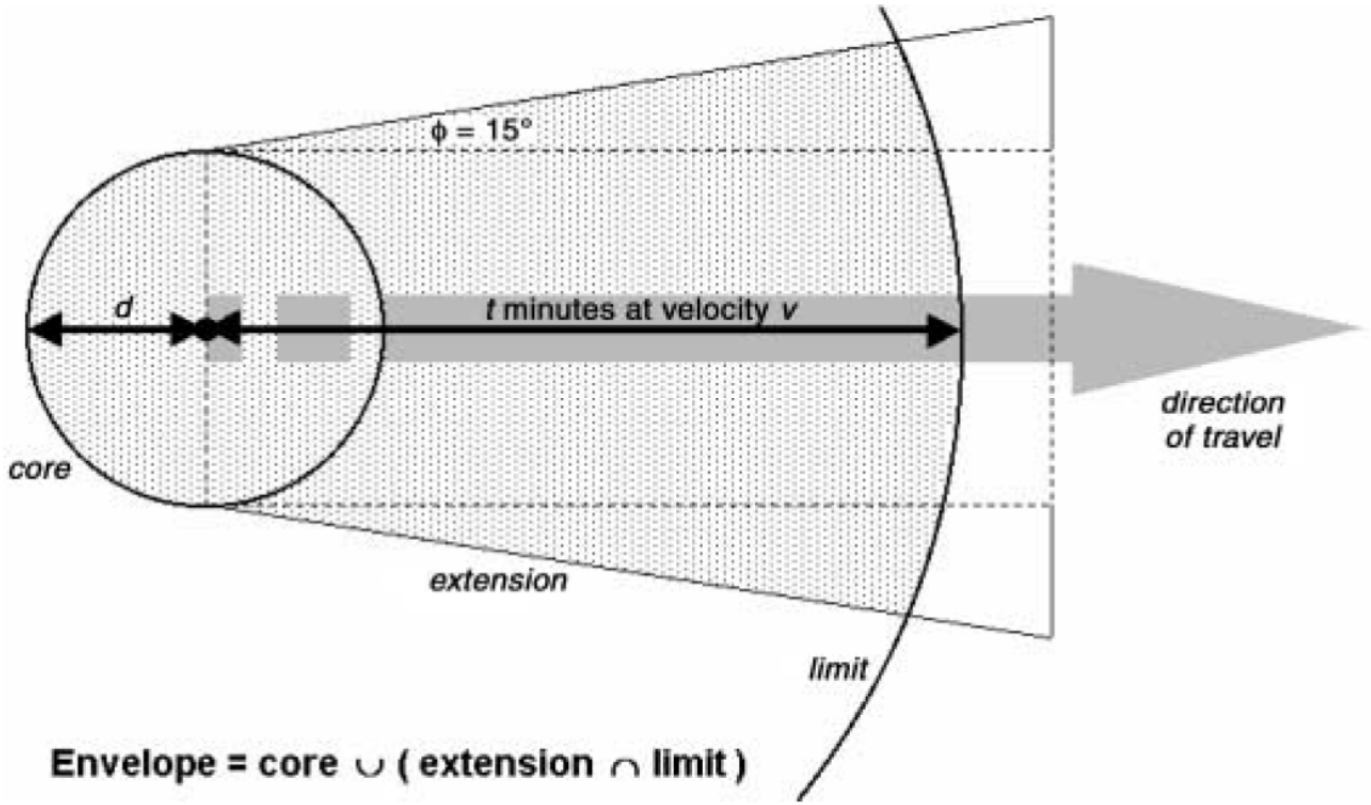
Some examples from Ming-Hsiang Tsou

http://geography.sdsu.edu/People/Faculty/tsou.html

Mobile GIS: http://map.sdsu.edu/mobilegis/

Location-based Services

- Requesting the nearest business or service, such as an ATM or restaurant
- Turn by turn navigation to any address
- Locating people on a map displayed on the mobile phone
- Receiving alerts, such as notification of a sale on gas or warning of a traffic jam
- Location-based mobile advertising
- Asset recovery combined with active RF to find, for example, stolen assets in containers where GPS wouldn't work


ϕ = 15°
d
t minutes at velocity v
direction
of travel
core
extension
limit
Envelope = core ∪ (extension ∩ limit)

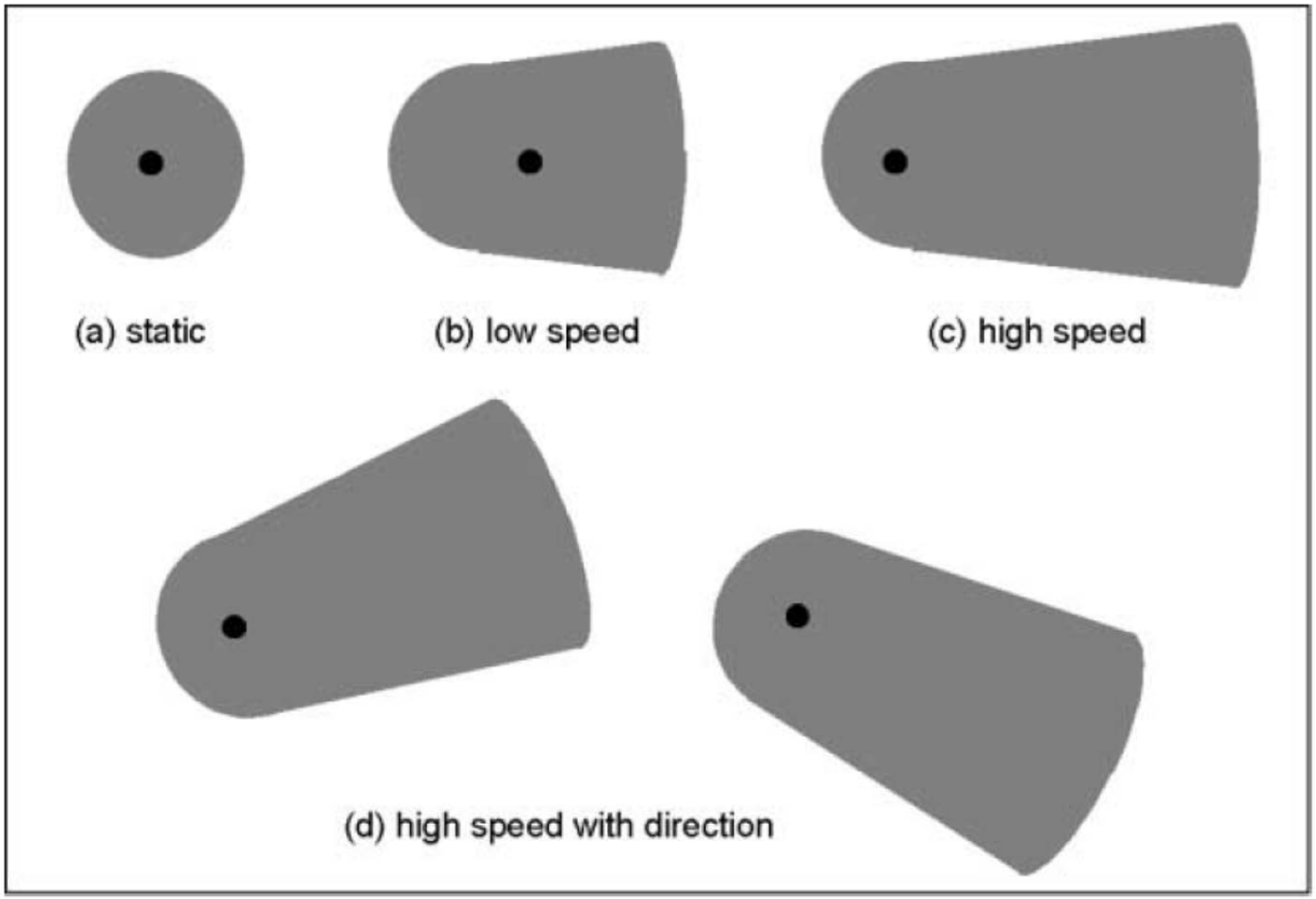
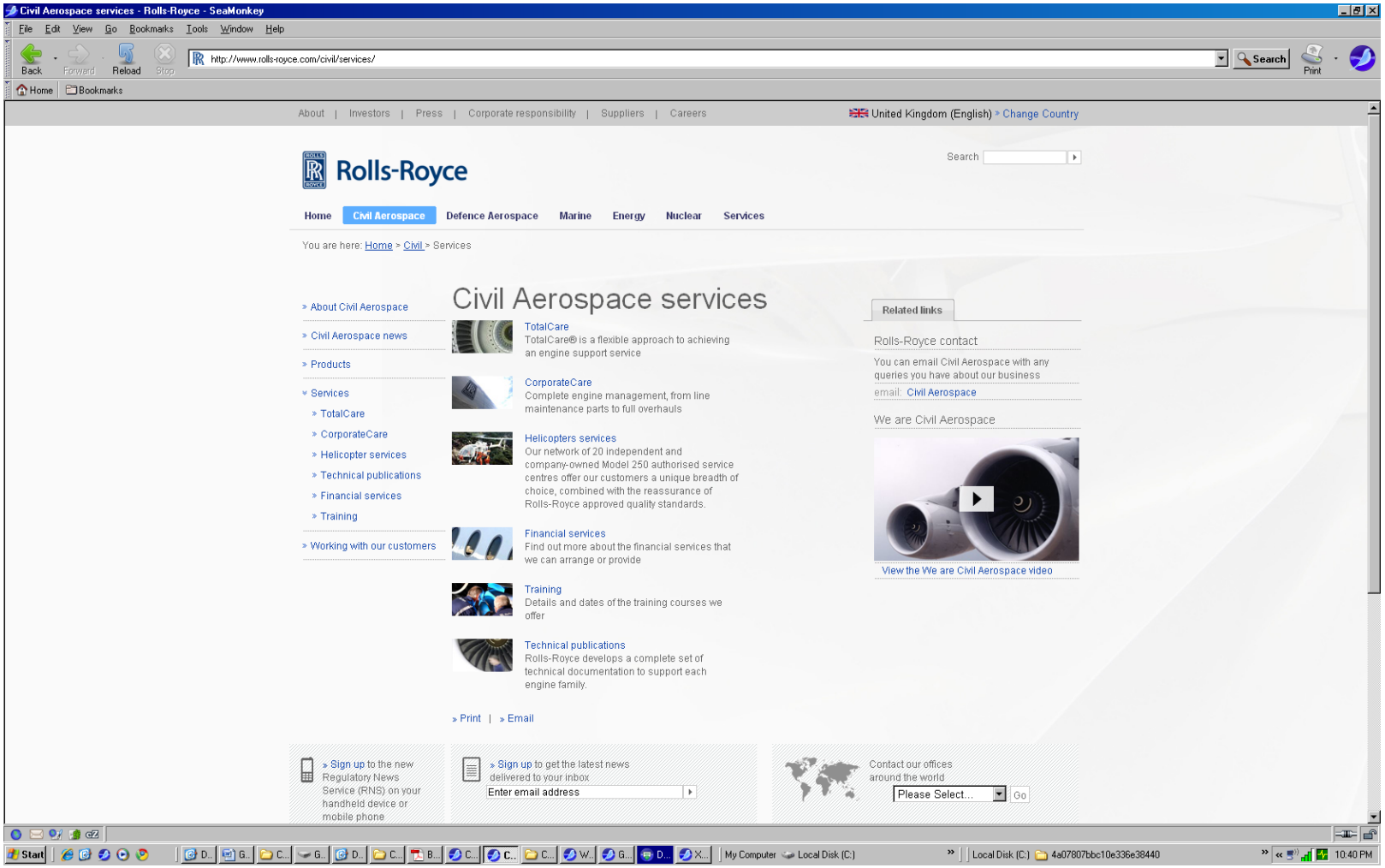


Figure 3 Examples of mobile space-time envelopes as a function of speed and direction

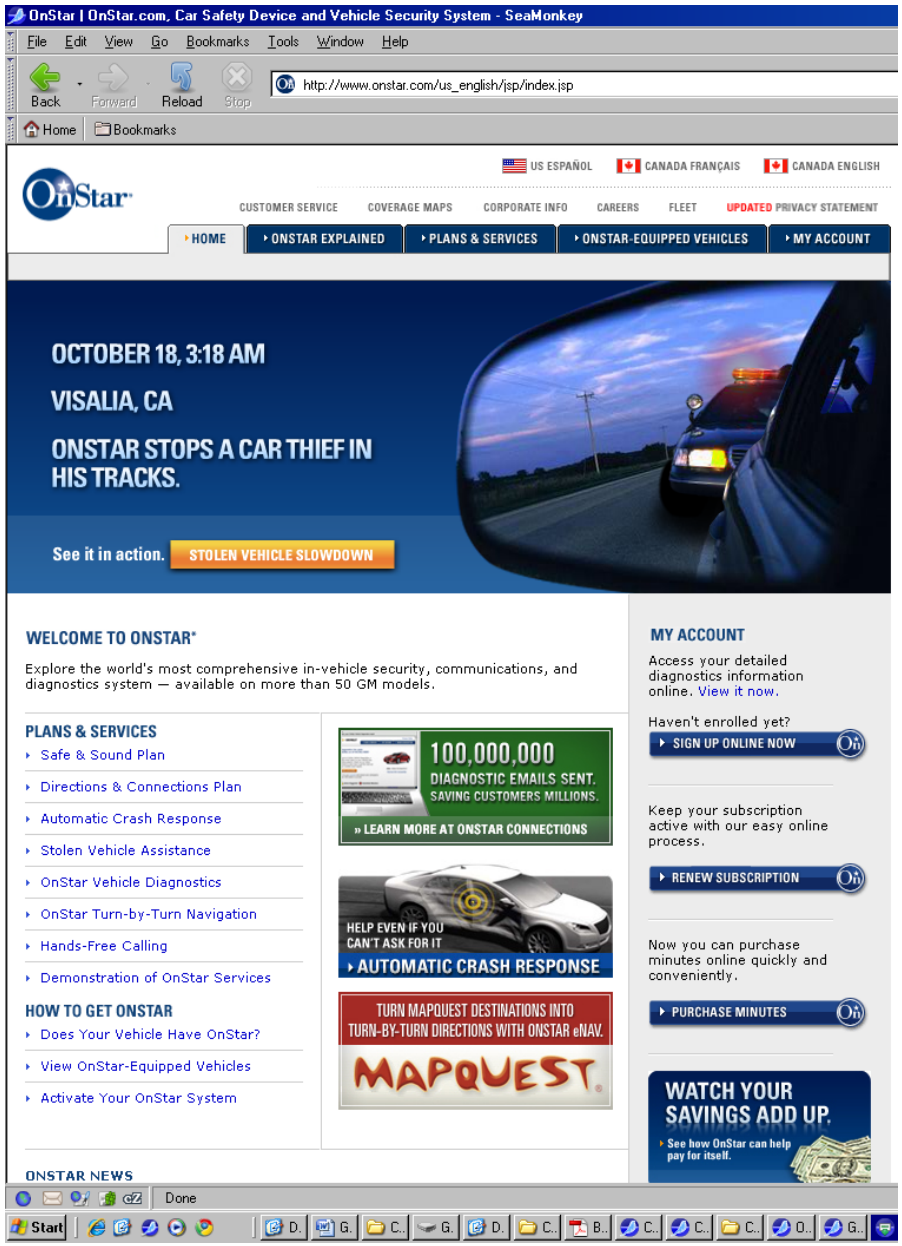
Pervasive/Ubiquitous Computing

http://www.computer.org/pervasive/

http://www.rolls-royce.com/civil/services/



http://www.onstar.com/



Energy Conservation

Environmental Monitoring

http://en.wikipedia.org/wiki/I-35W_Mississippi_River_bridge

Natural Hazards

1. **Anticipating conditions which may lead to emergencies**

2. **Rescue efforts**

Data Mining and Knowledge Discovery

Data mining, which is the partially automated search for hidden patterns in large databases, offers great potential benefits for applied GIS-based decision-making. Recently, the task of integrating these two technologies has become critical, especially as various public and private sector organisations possessing huge databases with thematic and geographically referenced data begin to realise the huge potential of the information hidden there. Among those organisations are:

1. offices requiring analysis or dissemination of geo-referenced statistical data
2. public health services searching for explanations of disease clusters
3. environmental agencies assessing the impact of changing land-use patterns on climate change
4. geo-marketing companies doing customer segmentation based on spatial location.

Examples of how public information can be "mosaiced"

1. Nielsen-Claritas PRIZM Market Segmentation widget http://www.claritas.com/MyBestSegments/Default.jsp

2. http://www.intelius.com/

3. http://www.usa-people-search.com/default.aspx

4. http://www.switchboard.com

5. Emerging Ethical Issues

Association of American Geographers, Statement on Professional Ethics, http://www.aag.org/cs/about_aag/governance/statement_of_professional_ethics

D. Research Involving Geospatial Technologies

Geospatial technologies currently used in geographical research and publication introduce special challenges with respect to potential violations of privacy and confidentiality of individuals and groups. In using these technologies, researchers should make reasonable efforts to protect the health, well-being, and privacy of research subjects. Decisions about the collection, ownership, and analysis of geospatial data should be made with a view toward affording individuals and communities that bear the burdens of geospatial research the opportunity also to share in its benefits. Particular efforts should be made to protect the privacy of geospatial data when such data could be used to undermine the interests of communities or community members and when specific agreements have been made to keep such data out of the public domain.

The following are examples of research approaches involving geospatial technologies that are particularly likely to raise privacy and confidentiality issues, and that therefore should be undertaken with special care:

(1) Automated tracking of the locations and movements of individuals or vehicles;

(2) The use of images from satellites, aircraft, or ground-based sensors that are of sufficient resolution to identify individuals or vehicles; and

(3) The use of geographic location, in the form of coordinates or street addresses, to link diverse sources of data of a personal nature.

New Tools, New Skills Needed

A. Emerging International and National Standards

- ISO (International Standards Institute)
- OGC (Open GIS Consortium) http://www.opengeospatial.org/
- US Spatial Data Transfer Standard

B. Common US Digital Formats (Governmental and commercial)

- Bureau of the Census TIGER
- USGS Digital Line Graphs (DLGs).
- USGS Digital Elevation Models (DEMs).
- USGS Digital Orthophoto Quadrangles (DOQs)
- AutoDesk DXF format
- ESRI e000 format

C. New Software Tools for Cartographers

Java, JavaScript, X-Windows, etc.

Education and Training--CU and elsewhere

Introductory Courses
Minimum: 3053 or 2053;
and 3023

GEOG 3053: Cartography 1: Visualization and Information Design *or* GEOG 2053: Mapping a Changing World

GEOG 3023: Statistics for Earth Sciences (*or equivalent*)

Intermediate Courses
Minimum: Both 4103 and 4023/4033

GEOG 4103/5103: Introduction to GIS (*3053 or 2053 required*)

GEOG 4023/5023: Intro to Quantitative Methods (*3023 or equivalent required*)

Advanced Courses
Minimum: Any 1 course.
Take more as possible

GEOG 4043/5043: Cartography 2: Interactive and Multimedia Mapping (*3053 or 2053 required*)

GEOG 4303/5303: GIS Programming (*4103 required*)

GEOG 4203/5203: GIS Modeling Applications (4103 *required and 4023/ 4033 recommended*)

GEOG 4093/5093: Remote Sensing of the Environment (*4023/4033 recommended*)

Education and Training:

- **Pennsylvania State University, World Campus, Certificate in GIS**
  http://www.worldcampus.psu.edu/pub/gis/index.shtml

- **UniGIS, MS program in GIS**
  http://www.unigis.org/

- **ESRI Education and Training with link to the Virtual Campus http:/www.esri.com/training/index.html**

Trends of Innovation: Barriers and Constraints to Change

1. The extraordinary potential of new geospatial technologies have been transformed rapidly into the ordinary…mirroring the rapid diffusion of the Web generally

2. Maps are becoming a pervasive part of the Web. Maps are being used to provide information, for marketing, for reference in ways that were difficult to imagine only a few years ago.

3. Personal digital assistants, wireless networks, GPS and other technologies are likely to sustain this trend for some time to come. A convergence of technologies is occurring--though developed independently, when used together they offer new and exciting opportunities

4. The role of the cartographer and GIS technologist is changing from the producer of a product to someone guiding the production process. Many challenges remain to make sure that users don't produce erroneous, misleading maps.

5. So far, most projects mirror the organization and features of paper maps and atlases. Perhaps some of the most interesting techniques are just around the corner….

6. The need remains for experimental, innovative projects that test capabilities and provide new models.

- **Effective use of multimedia resources—sound, animation, etc.**
- **Handheld and mobile technologies**
- **Real-time mapping and GIS**
- **Virtual reality, maps and worlds**