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INTRODUCTION TO GEOMATICS and GEOSPATIAL TECHNOLOGIES

New Technologies for water management

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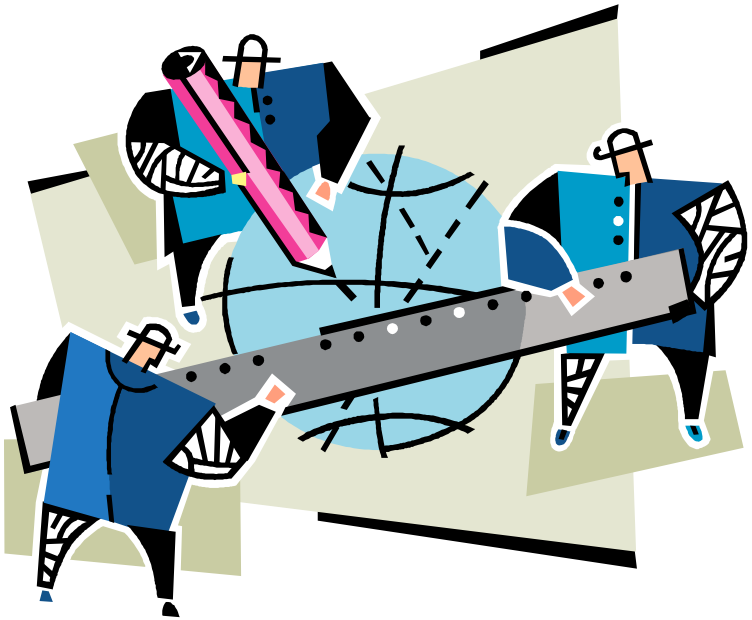
Geomatics ?
(University of Calgary 1979)

Geomatics Engineering is an emerging information technology in the 21st Century. Geomatics deals with the acquisition, modeling, analysis and management of spatial data and includes exciting applications such as positioning by satellites, remote sensing, land surveying, and geospatial information management.

Geomatics ?
(Oxford Dictionary - 2006)

The mathematics of the earth;
the science of the collection, analysis, and interpretation of data, especially instrumental data, relating to the earth's surface.



Geomatics ?

(Elementary Surveying, an introduction to geomatics by Ghilani and Wolf- 2010)

Geomatics is a relatively new term that is now commonly being applied to encompass the areas of practice formerly identified as surveying.

The name has gained widespread acceptance in the United States, as well as in other English-speaking countries of the world, especially in Canada, the United Kingdom, and Australia. Many college and university programs that were formerly identified as "Surveying" or "Surveying Engineering" are now called "Geomatics" or "Geomatics Engineering."

Surveying ?

(Elementary Surveying, an introduction to geomatics by Ghilani and Wolf- 2010)

Surveying, which is also interchangeably called geomatics, has traditionally been defined as the science, art and technology of determining the relative positions of points above, on, or beneath the Earth' surface or of establishing such points.

Surveying ?

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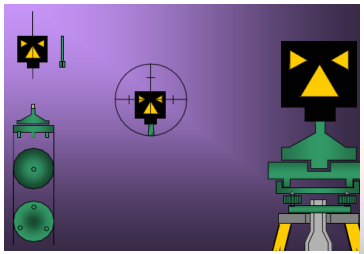
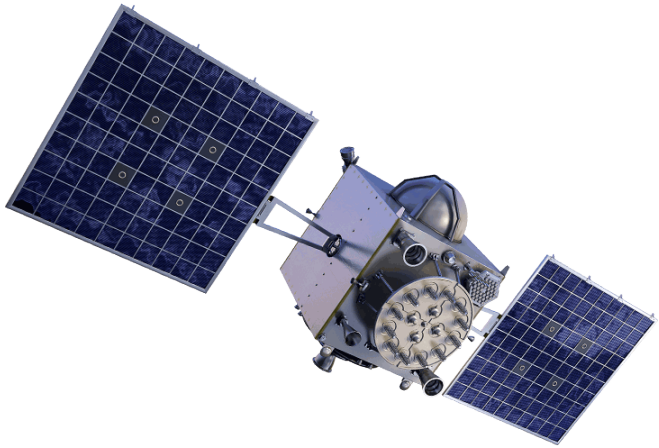
In a more general sense, however, surveying can be regarded as that discipline which encompasses all methods for measuring and collecting information about the physical earth and our environment processing that information and disseminating a variety of resulting products to a wide range of clients.

Surveying instruments





Geomatics vs Surveying?

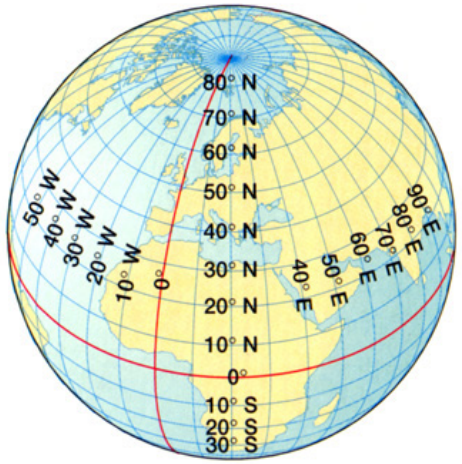
The principal reason cited for making the name change is that the manner and scope of practice in surveying have changed dramatically in recent years. This has occurred in part because of recent technological developments that have provided surveyors with new tools for measuring and/or collecting information, for computing, and for displaying and disseminating information. It has also been driven by increasing concerns about the environment, locally, regionally and globally, which have greatly exacerbated efforts in monitoring, managing, and regulating the use of our land, water, air and other natural resources with demands for new spatially related information.

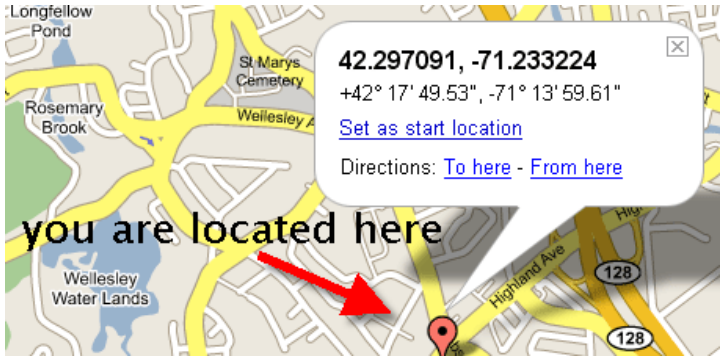
What's there in Geomatics???

- Geodesy
- Global positioning system(GPS) or Global navigation satellite system(GNSS)
- Surveying (cadastral, aerial, mining and engineering surveying)
- Navigation AND Location-based services
- Cartography , Geovisualization and Digital mapping
- Geographic information systems (GIS)

What are Geospatial Technologies?

"Technology relating to the collection or processing of data that is associated with location."



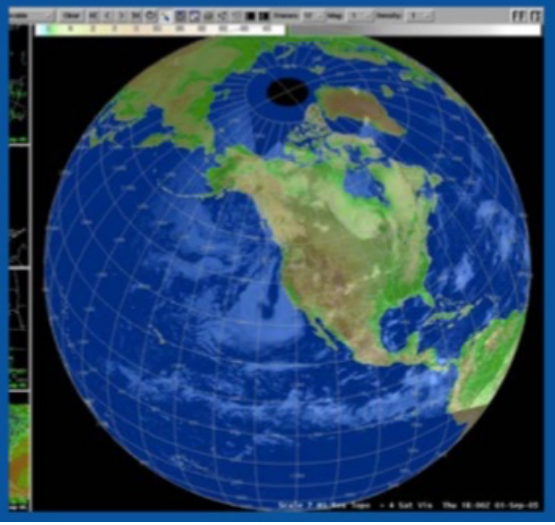


Common Examples of Geospatial Technologies:

- *Global Positioning Systems (GPS):* A satellite-based geolocation system that functions worldwide and is accessible to the public via GPS units

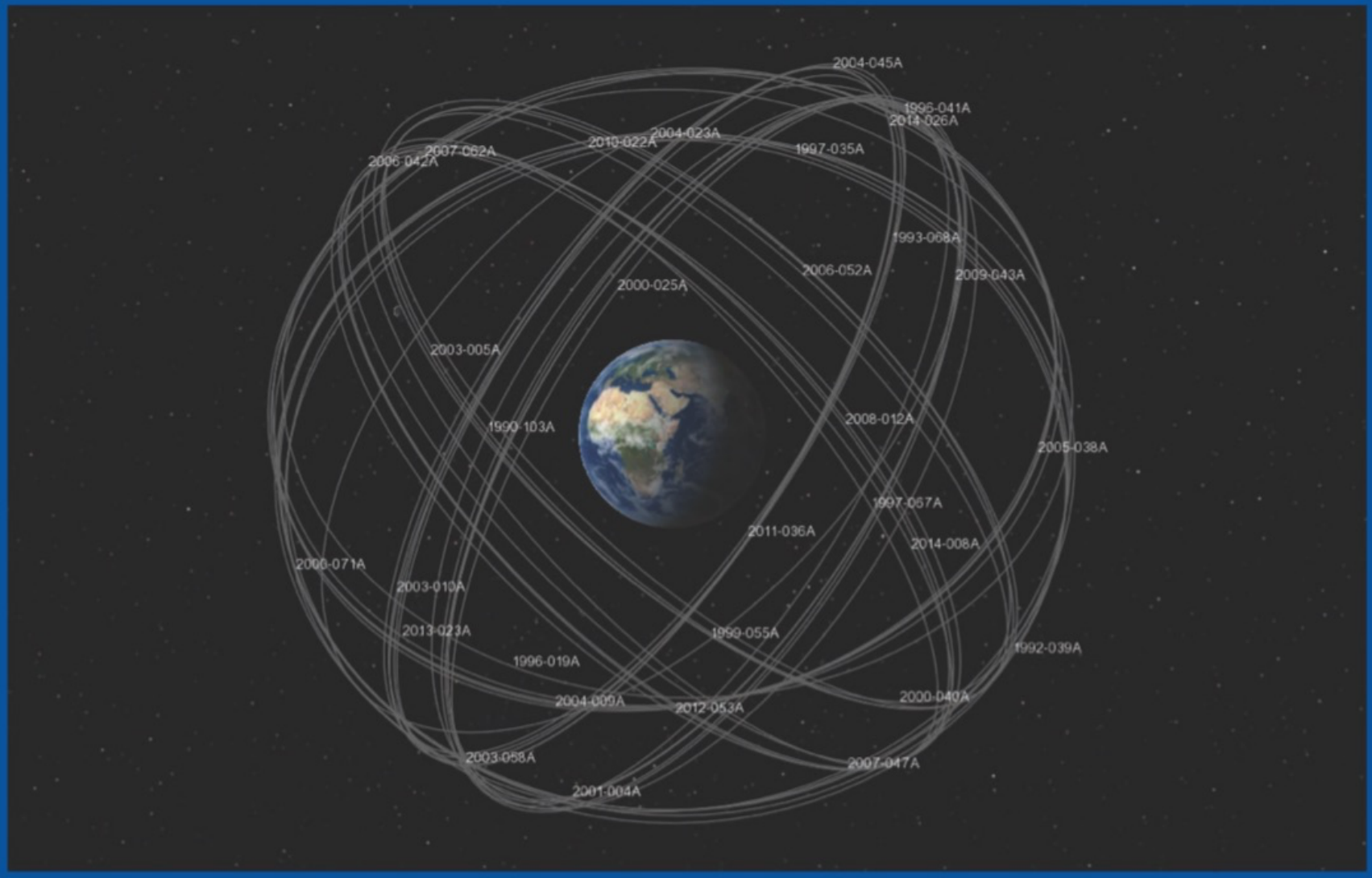
- *Remote Sensing:* The acquisition of images and information from afar

- *Geographic Information Systems (GIS):* information systems enabling the creation, organization, and presentation of data in a spatially referenced form, as well as the production of maps and charts



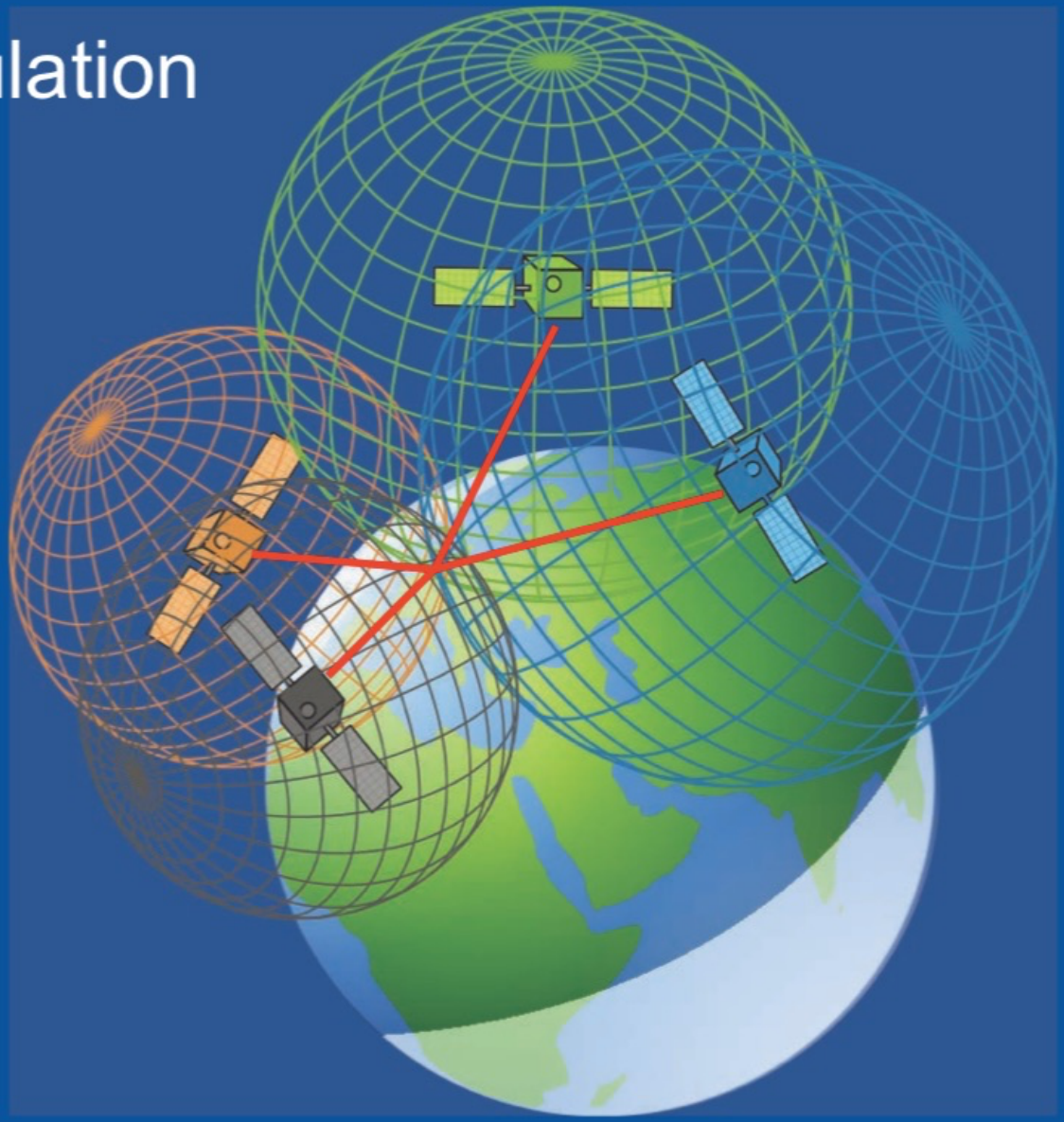
GPS (GNSS)

1: Signals Broadcast



GPS (GNSS)

2: Triangulation



GPS (GNSS)

3: End User

Remote Sensing

- Images and data collected remotely
  - Often by satellite, but other platforms also exist
- Information stored digitally, transmitted electronically
- Often includes information invisible to human eye
- Fully georeferenced

Remote Sensing

- High Resolution
  - Best for observing “human scale” phenomena
  - Highly targeted
  - Narrow field of view
- Low-Resolution
  - Best for regional phenomena
  - Collected systematically
  - Wide area collected with each pass

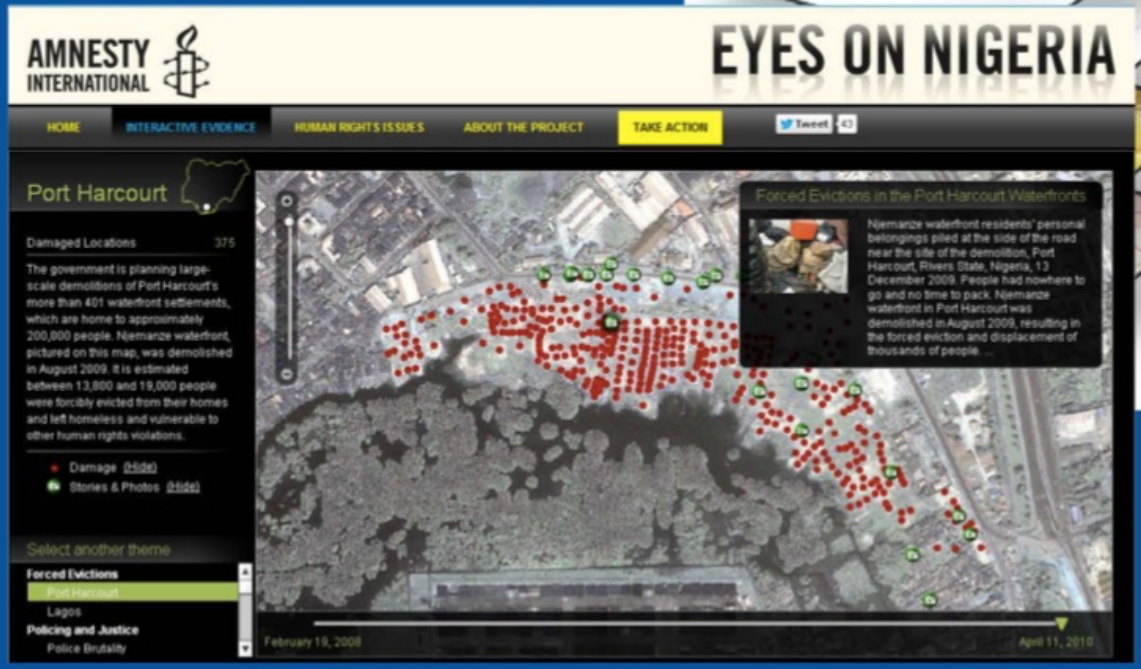
Remote Sensing

- Multispectral
  - Images in color
  - Able to discern material types
  - Post-processing often required
  - Higher cost
- Panchromatic
  - Black and white
  - Wider field, more coverage, less expensive
  - More difficult to interpret

Geographic Information Systems (GIS)

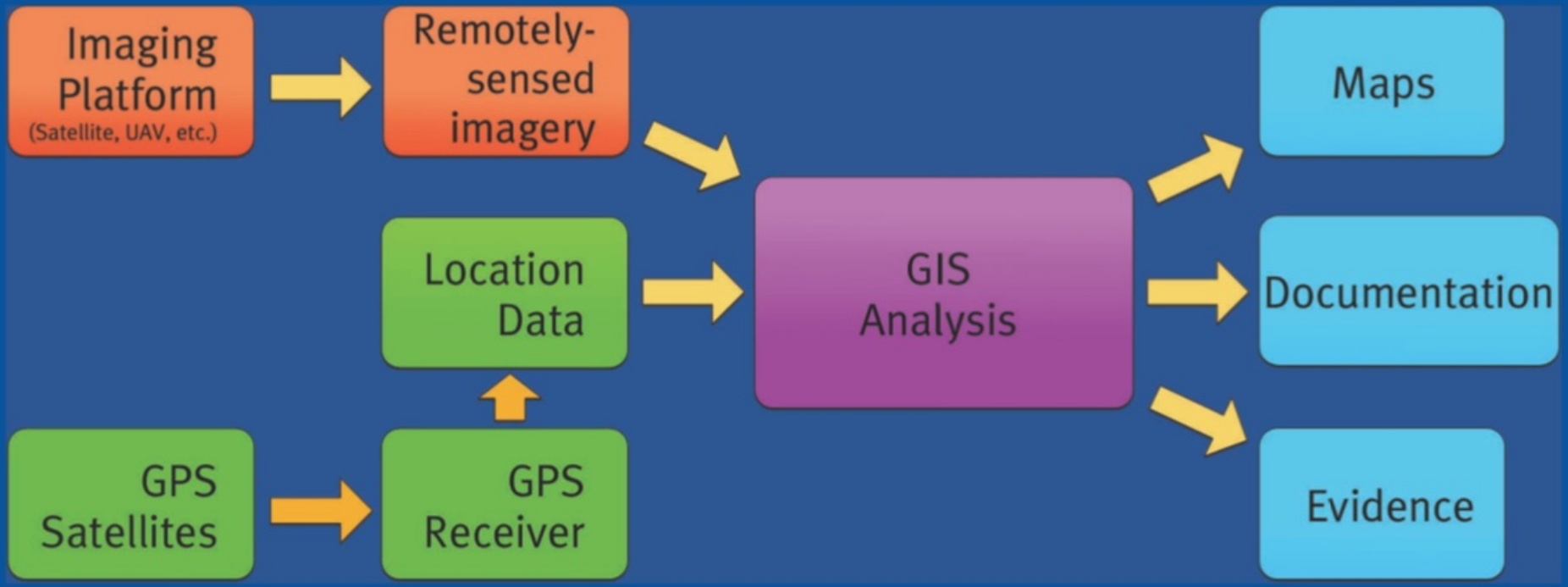
Why use GIS

- Synthesizes different types of geospatial data
- Reveals spatial patterns
- Simplifies confirmation of observations by others



Putting all together

Sample workflow:

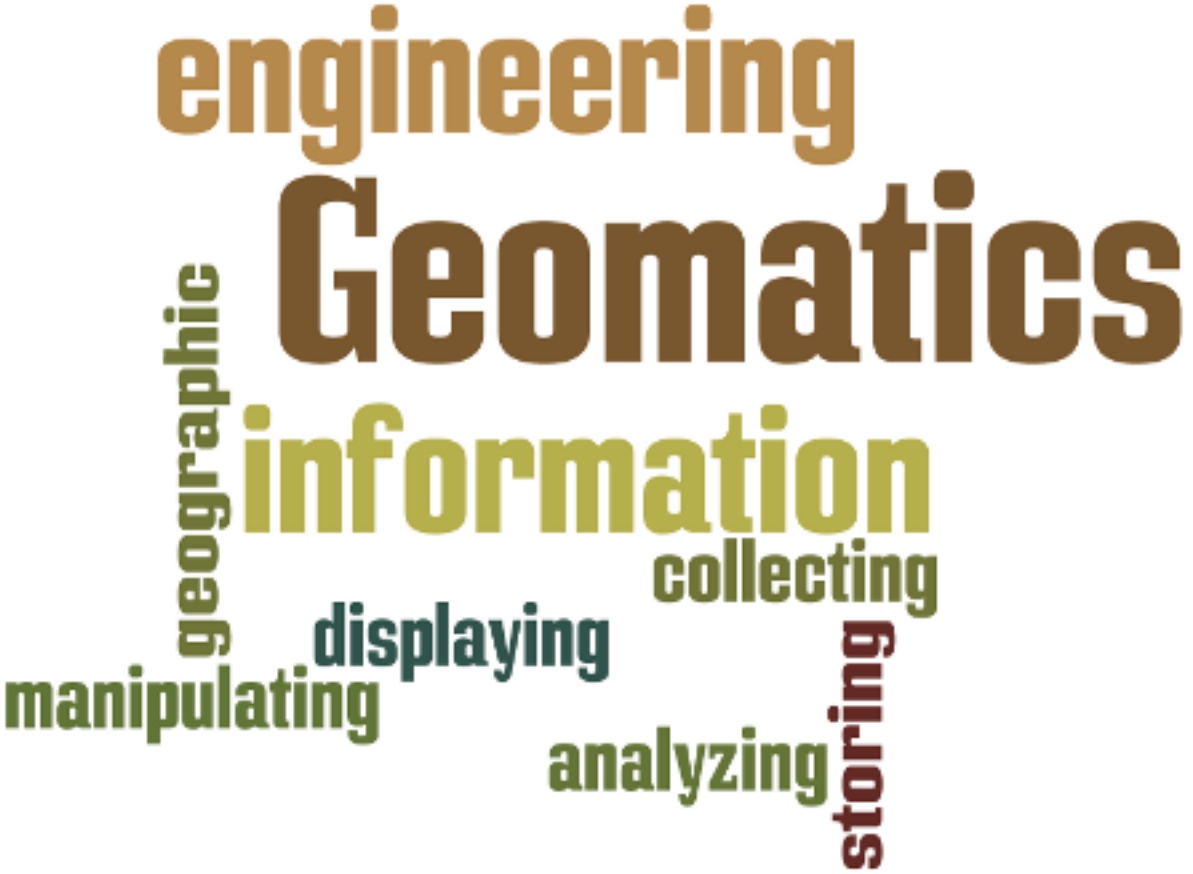


Geomatics

- So now we have and idea about geomatics:
  - Deal with characteristics and structure of spatial data on the Earth surface
  - Deal with environment

Practically the core of the GIS

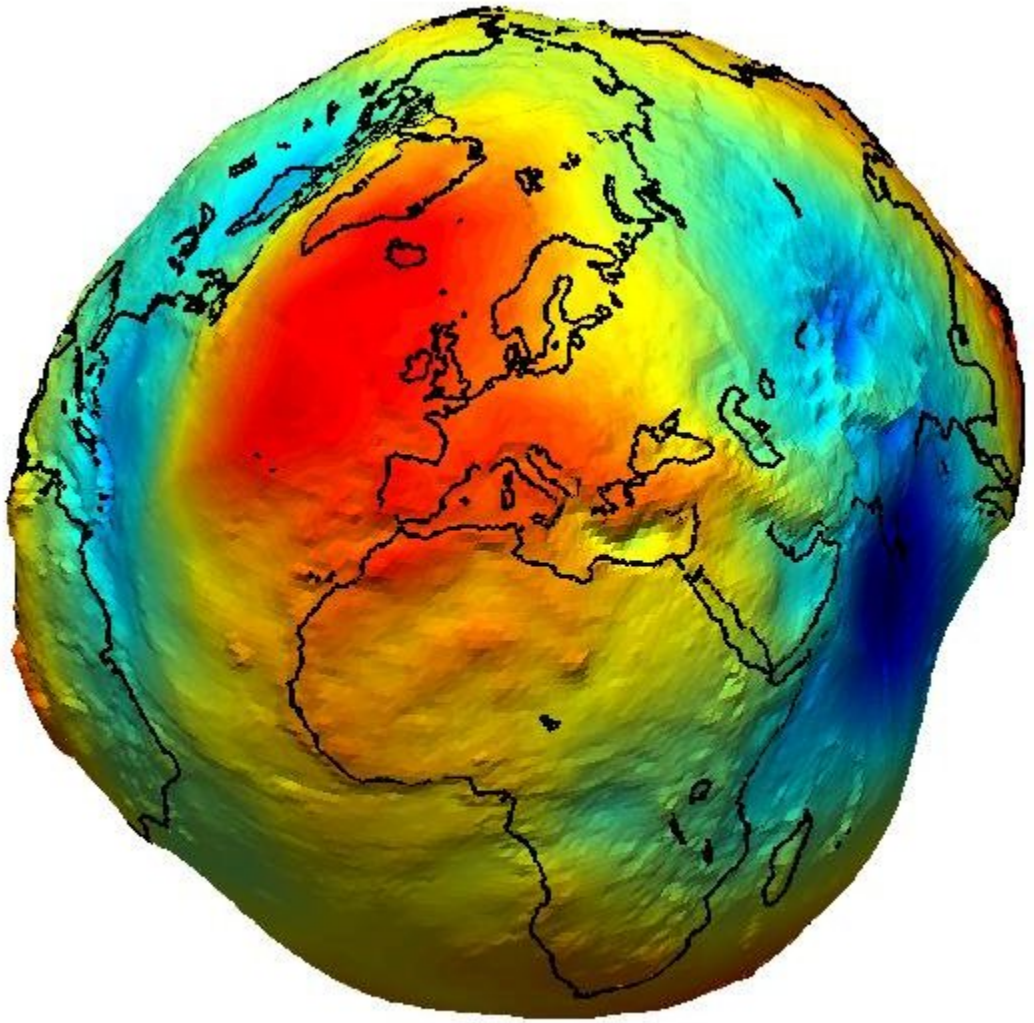
The fundamentals of CARTOGRAPHER


engineering
Geomatics
geographic
information
collecting
displaying
manipulating
analyzing
storing

Geodesy? The shape of the Earth

The external shape of the Earth is not regular

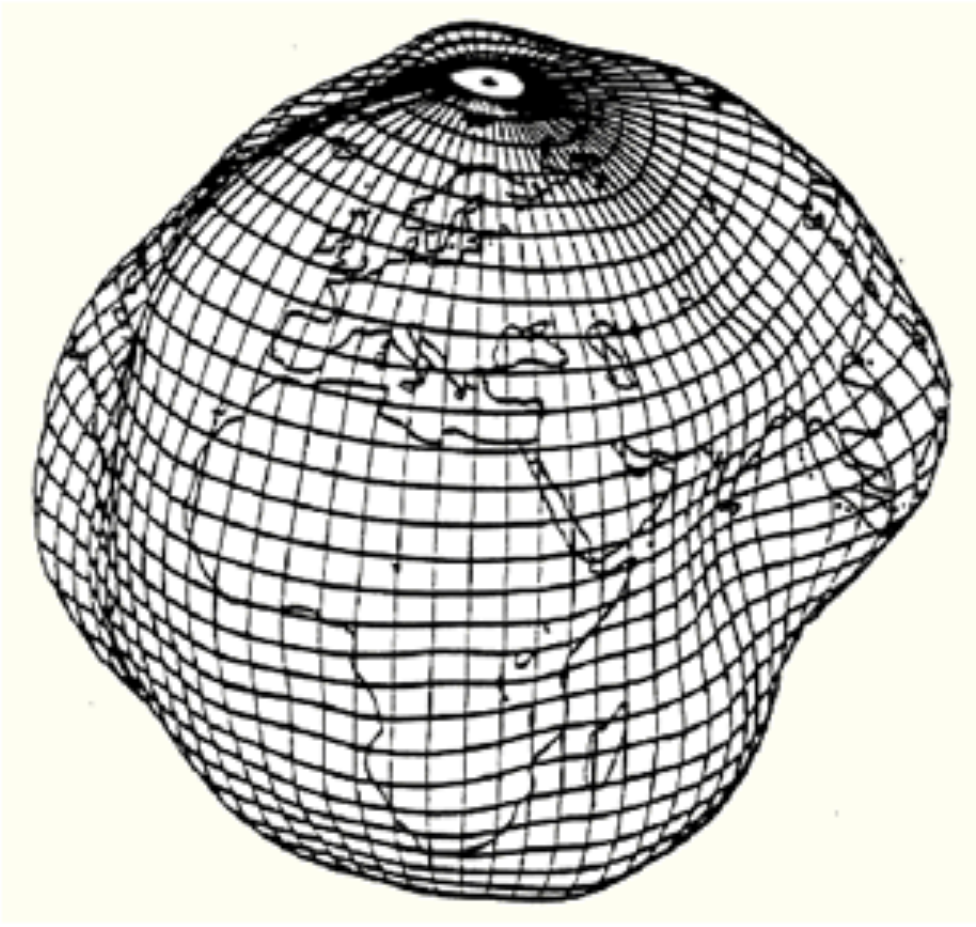
This image is derived from data acquired by satellite GOCE



… BUT with heights "exagerated"

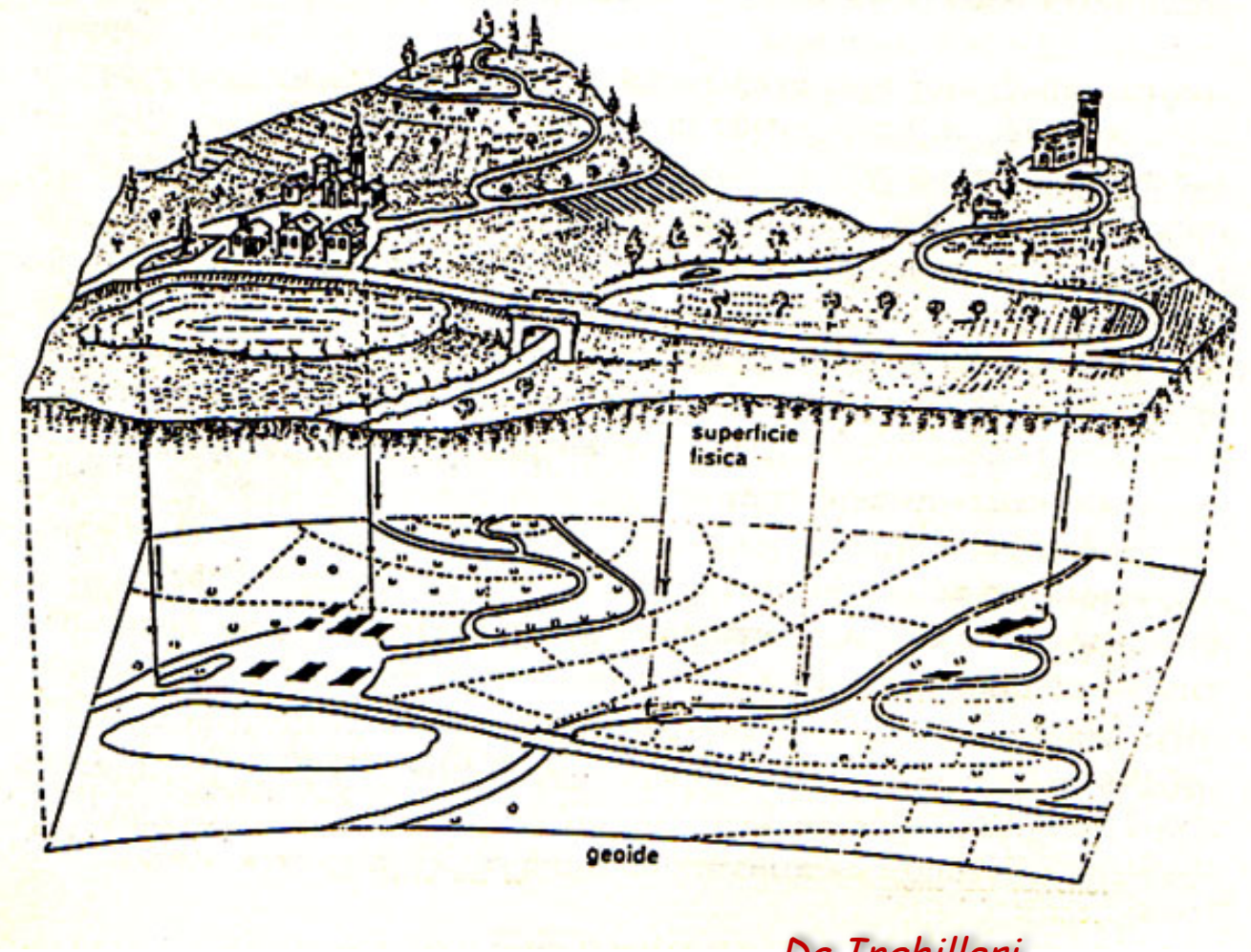
geodesy

Geodesy studies the shape and size of the earth, in a geometric sense, as well as the shape of the equipotential surface determined by the gravity



topography

Topography defines a complex of measurements, calculation and design techniques that allows to define metrically and to represent the terrain in a convenient way for the various purposes



Da Inghilleri

Cartography

(Encyclopaedia Britannica 2017)

the art and science of graphically representing a geographical area, usually on a flat surface such as a map or chart.

It may involve the superimposition of political, cultural, or other non geographical divisions onto the representation of a geographical area.

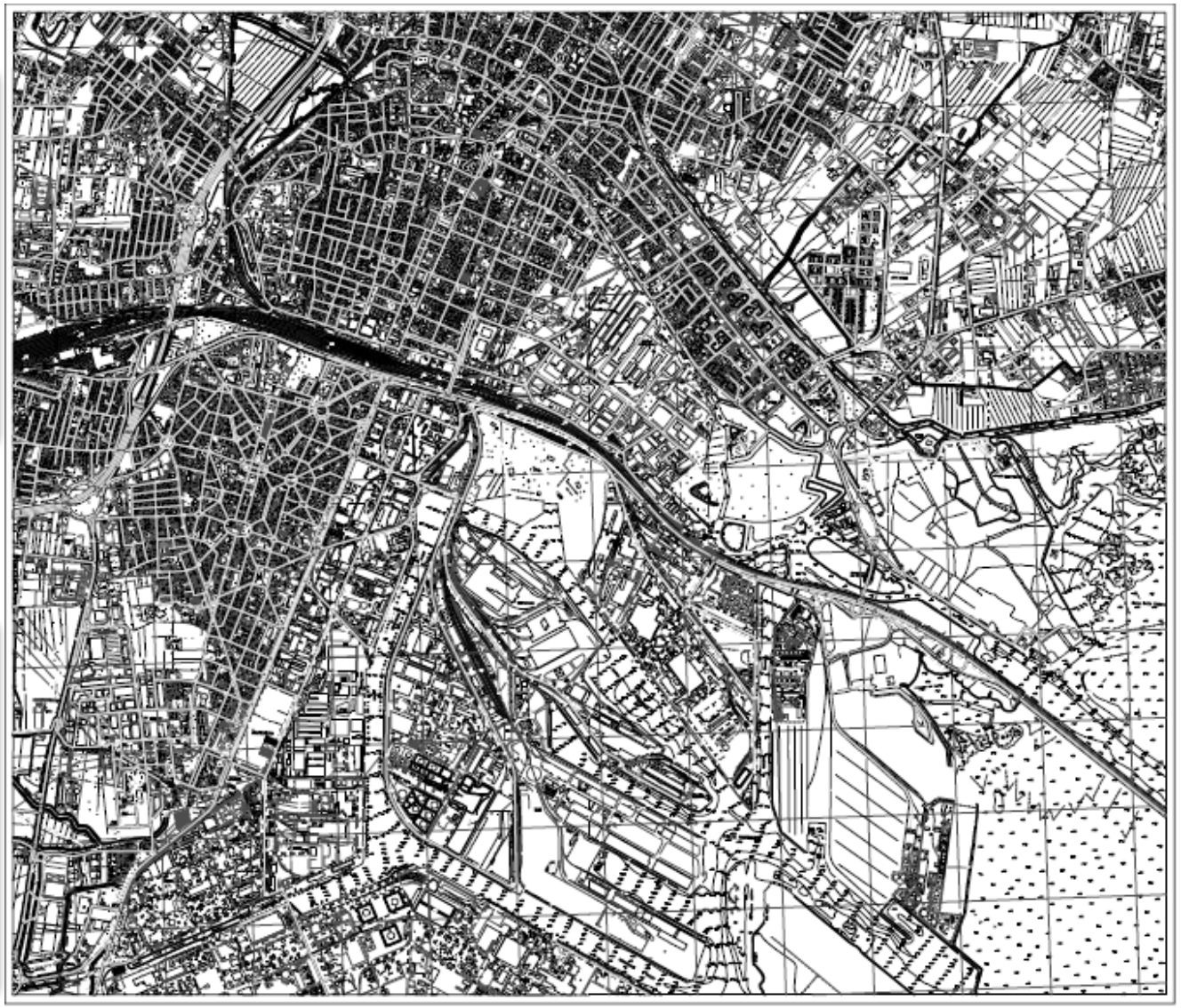
"Cartography is the science that teaches how to draw on a flat surface (a sheet of paper) the Earth's curved surface and the phenomena associated with it, using the greatest possible evidence and truth, and so that you can easily obtain the relationships between elements of a surface, known those on the other"

Giuseppe Birardi (1982)

cartography

The representation on the plane of an irregular surface

An example of technical cartography for urban and planning use



Aerophotogrammetrical plotting

Cartography is an ancient discipline that dates from the prehistoric depiction of hunting and fishing territories. The Babylonians mapped the world in a flattened, disk-shaped form, but Claudius Ptolemaeus (Ptolemy) established the basis for subsequent efforts in the 2nd century BC with his eight-volume work Geōgraphikē hyphēgēsis (Guide to Geography) that showed a spherical Earth.

Ptolemy's map of the world, as printed at Ulm, Ger., 1482. *Library of Congress, Washington, D.C.*

Maps produced during the Middle Ages followed Ptolemy's guide, but they used Jerusalem as the central feature and placed East at the top.

Those representations are often called T-maps because they show only three continents (Europe, Asia, and Africa), separated by the "T" formed by the Mediterranean Sea and the Nile River.

More accurate geographical representation began in the 14th century when portolan (seamen's) charts were compiled for navigation.