

APPLICATIONS OF IT



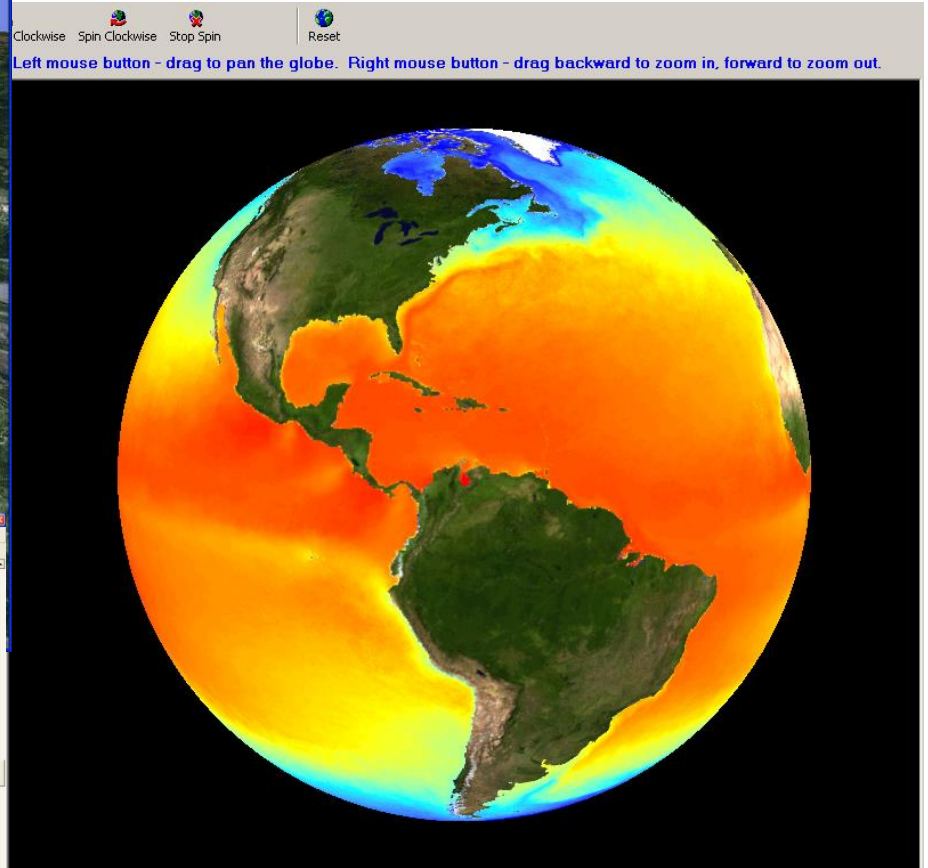
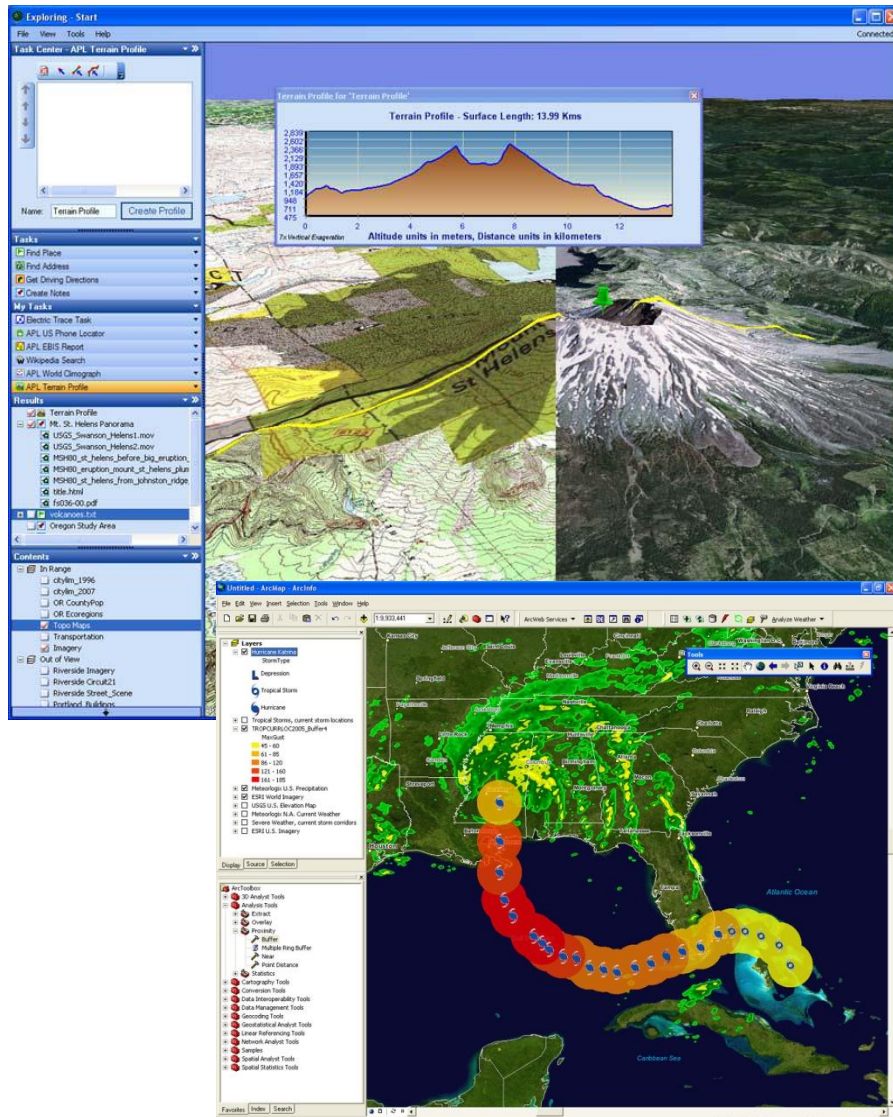
**UNIVERSITY
OF PETROLEUM
& ENERGY STUDIES**

An Introduction to GIS



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What is GIS?



What is GIS?

- GIS = Geographic Information System
 - ▶ Links databases and maps
 - ▶ Manages information about places
 - ▶ Helps answer questions such as:
 - Where is it?
 - What else is nearby?
 - Where is the highest concentration of 'X'?
 - Where can I find things with characteristic 'Y'?
 - Where is the closest 'Z' to my location?

GIS

- Geographic Information Systems
 - ▶ Simple: Tables and Maps
 - “a powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world” (Burrough, 1986)
 - “any manual or computer based set of procedures used to store and manipulate geographically referenced data” (Aronoff 1989)
 - “a decision support system involving the integration of spatially referenced data in a problem solving environment” (Cowen 1988)
 - ▶ “Systems that know how to deal with stuff in space” (Herrington 1998)

GIS in Education

- Over 7,000 universities worldwide teach GIS
- GIS used in multiple disciplines:

Agriculture

Archaeology

Architecture/Landscape Arch.

Business

Computer Science

Environmental Science

Engineering

Journalism

Military Science

Natural Resource Management

Geography

Geology

Meteorology

Oceanography

Law Enforcement

Public Health

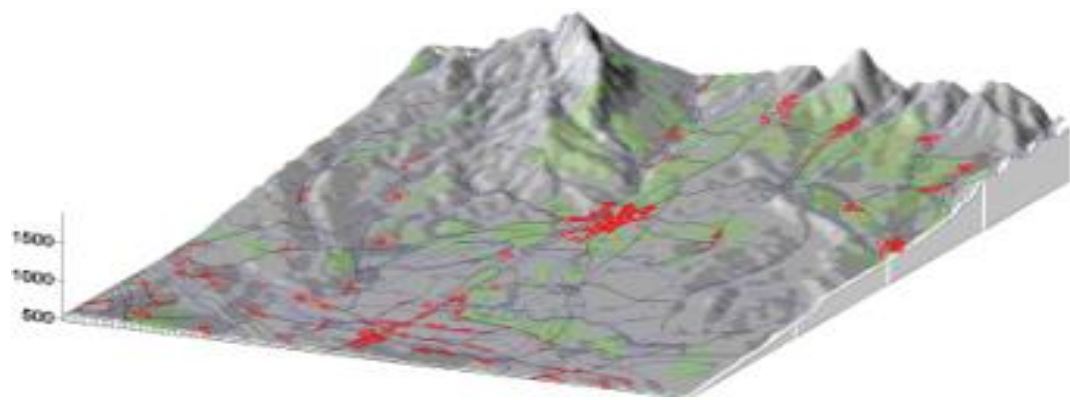
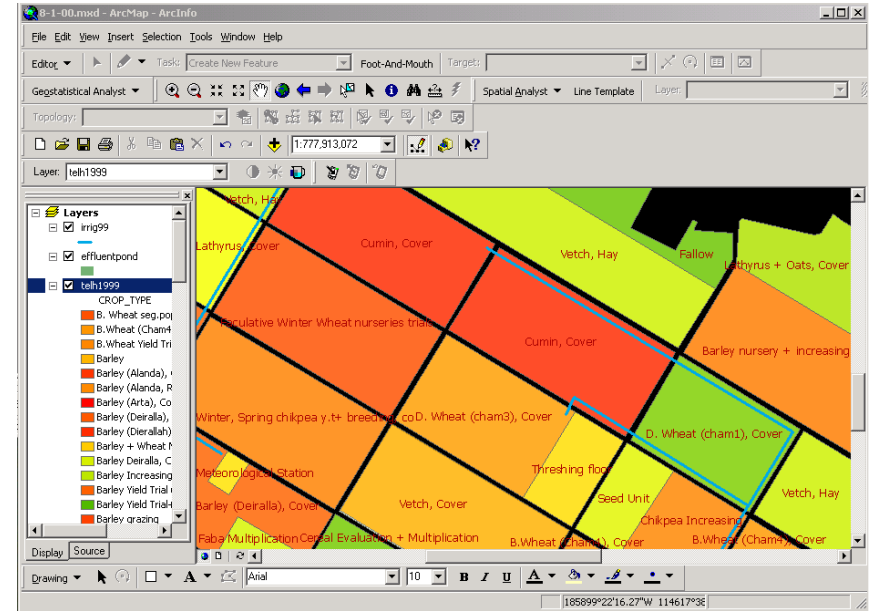
History

Sociology

Urban/Regional Planning

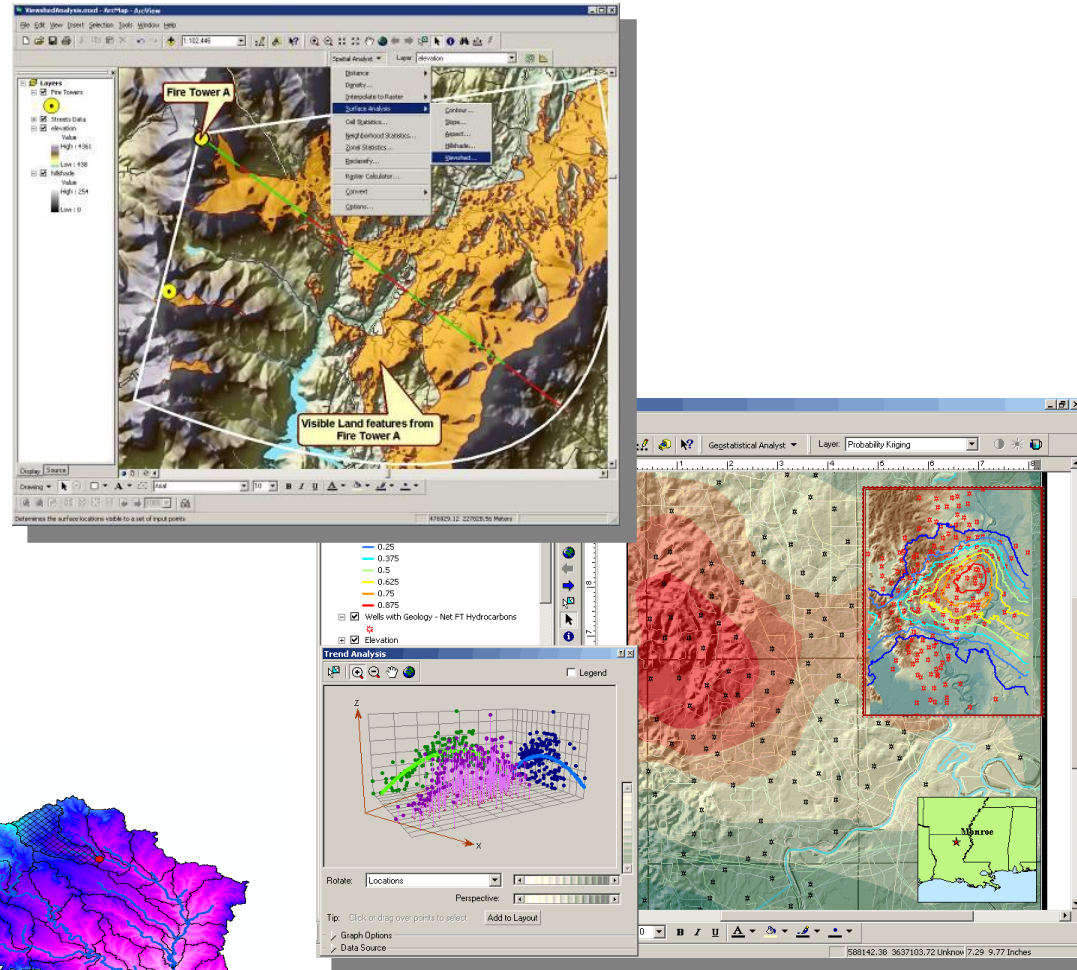
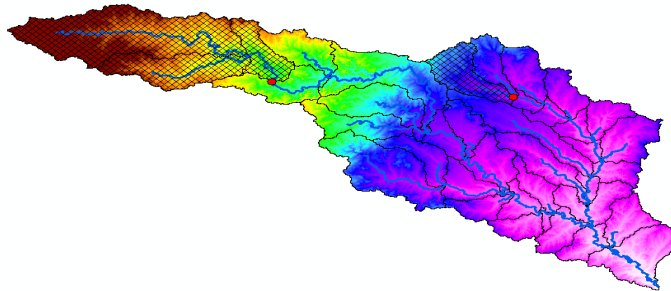
Agriculture

- ▶ Farm management
- ▶ Pest/Disease tracking
- ▶ Crop monitoring
- ▶ Yield prediction
- ▶ Soil analysis



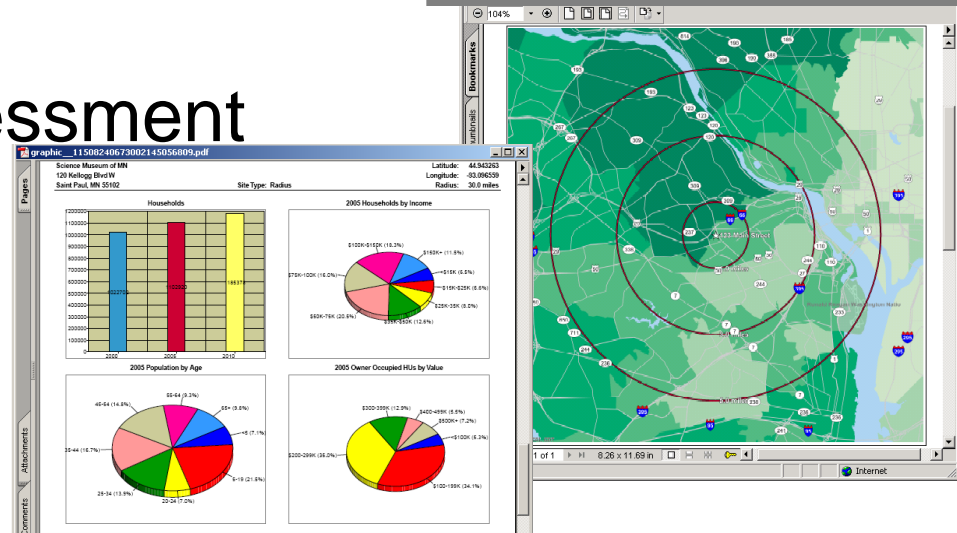
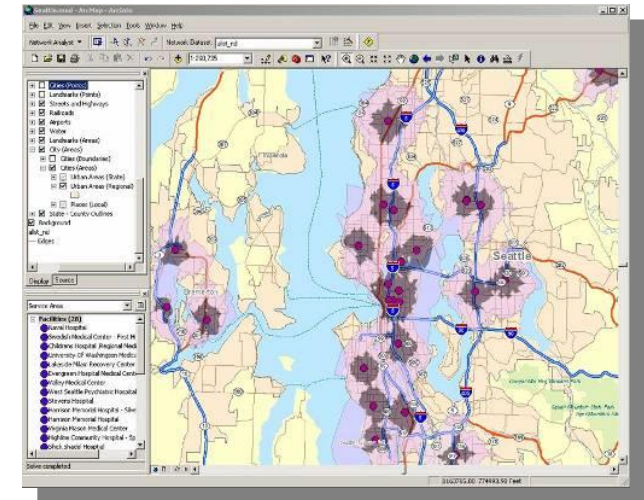
Natural Resource Management

- Forestry
- Ecology
- Mining
- Petroleum
- Water Resources

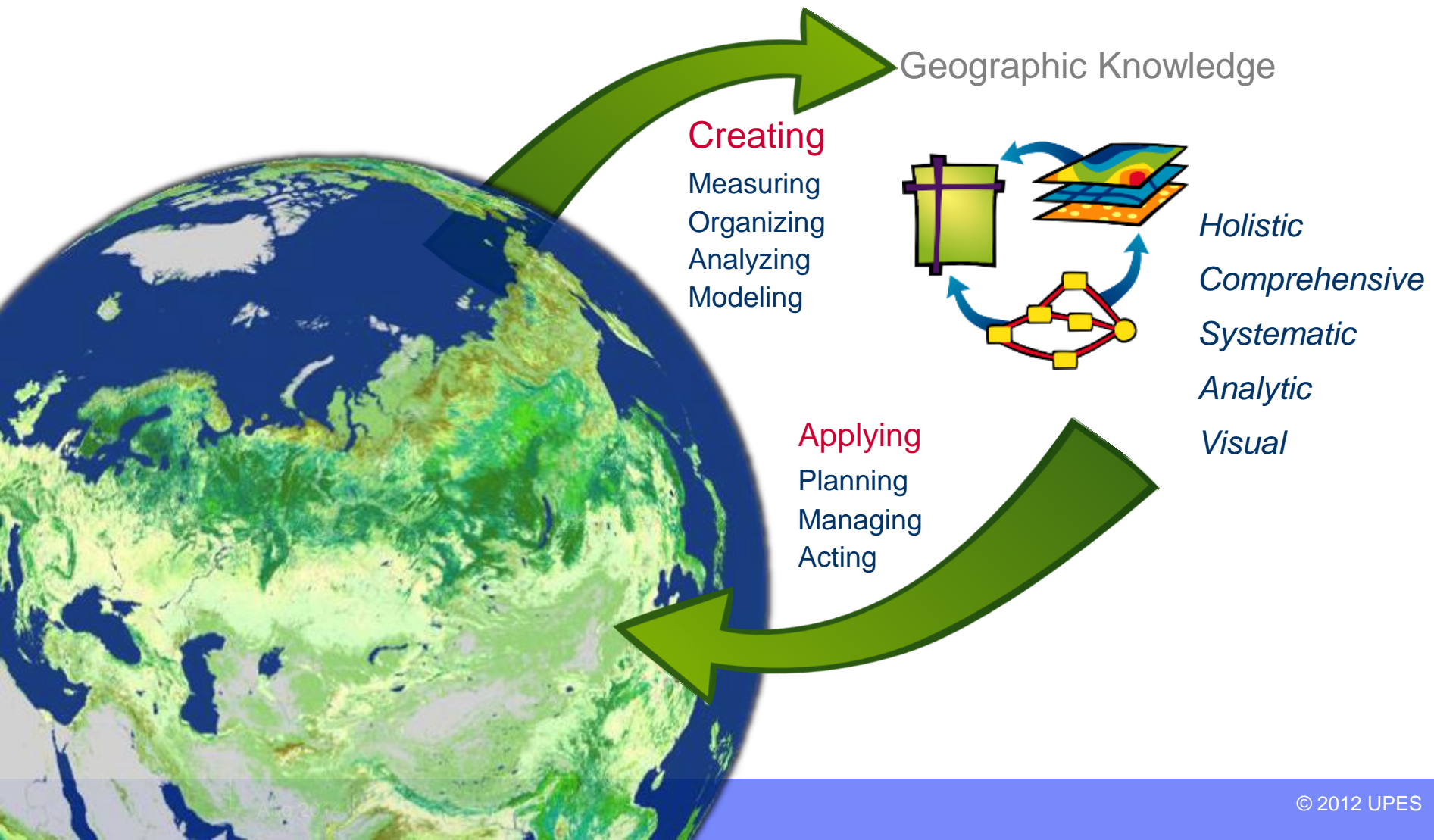


Planning and Economic Development

- Land Use/Zoning
- Emergency Preparedness
- Population Forecast
- Market Analysis
- Property Tax Assessment
- Transportation



GIS: A Framework for Understanding and Managing Our Earth



GIS enhances education because it is:

- Multi-disciplinary
- A real-world technology using real data
- Involves authentic tasks / assessments
- Promotes holistic / systematic approach
- Engages multiple ways of learning
- Encourages community connections
- Used at scales from local to global

Geography matters

Today's challenges require geographic approach

- Climate Change
- Urban Growth
- Sustainable Agriculture
- Water Quality and Availability
- International and National Security
- Energy
- Epidemiology/Disease Tracking
- Natural Hazards: Seismicity, Weather Events

GIS skills needed in workforce

- 2004: US Secretary of Labor identifies geospatial technology as one of the 3 most important evolving fields.
- GIS part of US Department of Labor High Growth Job Training Initiative
- Emily DeRocco, US Dept of Labor Employment and Training Administration: 2005 budget includes \$1.6 billion for secondary, technical, and adult education programs.

GIS and Distance Education

- Current workforce needs GIS training, distance education meets their needs
- Examples of online GIS programs:
 - ▶ University of California Riverside
 - ▶ Emporia State University
 - ▶ University of Montana
 - ▶ University of Denver
 - ▶ Louisiana Tech University
 - ▶ Pennsylvania State University
 - ▶ Northwest Missouri State University

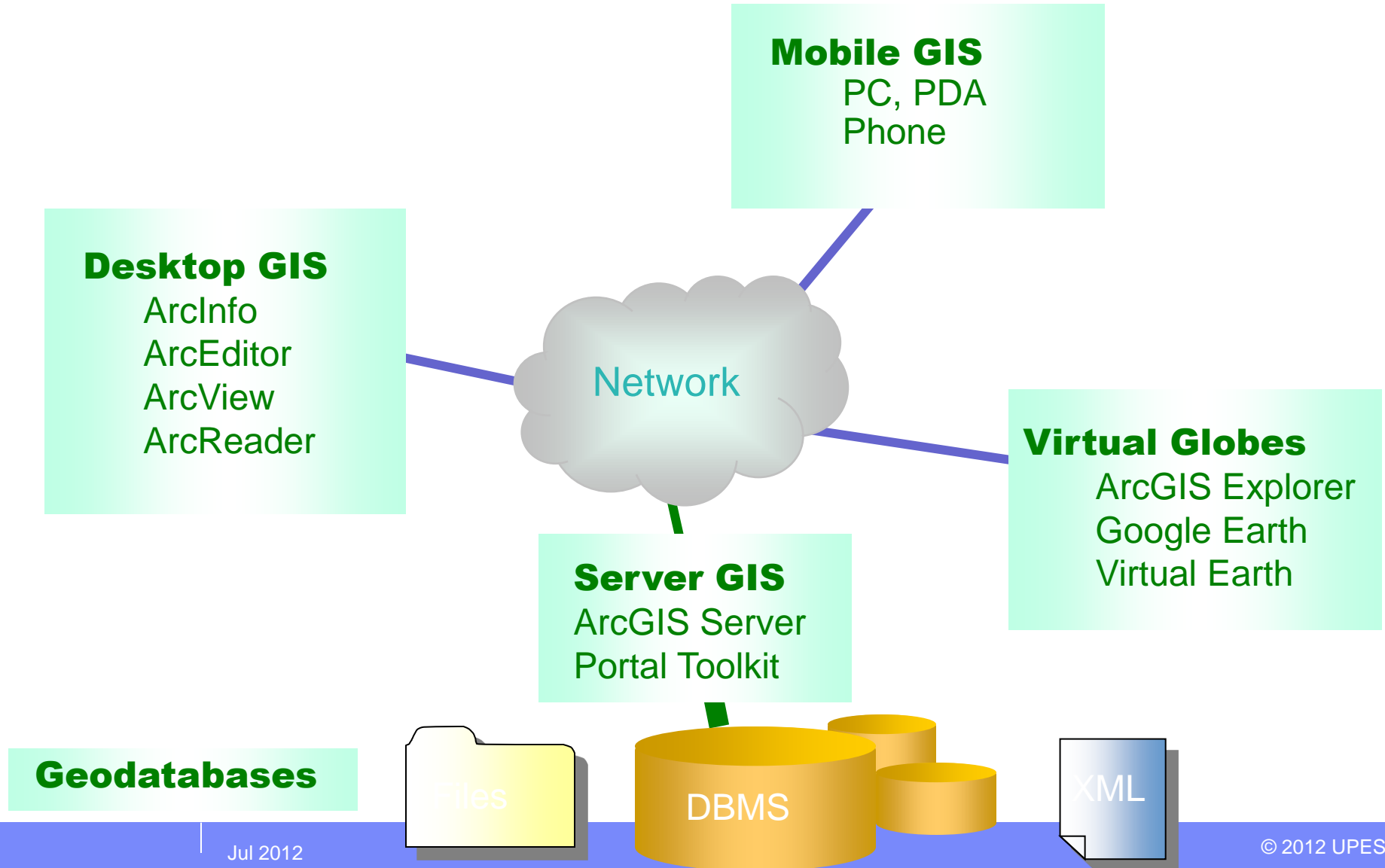
GIS as Infrastructure

- Because GIS is used in many departments, coordination is needed
 - ▶ Software licensing
 - ▶ Instruction
 - ▶ Data

GIS as infrastructure

- Data is greatest expense
 - ▶ Previously: Data scattered in multiple departments, not coordinated
 - ▶ Future: Data accessible anywhere, GIS portal and Web services facilitate sharing
- Libraries / Data Centers key
 - ▶ GIS data has unique characteristics

GIS as infrastructure



SCADA System



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Introduction (What Is SCADA?)

- Stands for supervisory control And data acquisition.
- SCADA systems are used in industrial processes: steel making, power generation (conventional and nuclear) and distribution.
- There Are 4 Components In the SCADA System.

SCADA Components

- Field Instrumentation.
 - Sensors, devices to control.
- Remote Terminal Units.
 - RTU Vs. PLC(programmable logic controller)
- Communications Network.

Equipment needed to transfer data to and from different sites
- Central Monitoring Station
 - Collecting information gathered by the remote stations to generate the necessary action

Disadvantages Of Relay Systems

Relays used only for on/off control.

Complicated control systems

Expensive System.

System takes up much floor and space.

Control relays are power- hungry, → heat generation.

Any change in control program requires the rewiring of relays.

For complicated control systems, it is difficult to troubleshoot and locate the faults.

Advantages Of SCADA systems

Easily programmed or reprogrammed

Easy maintained (self diagnostic).

Capability to do arithmetic function.

The ability to communicate with other controller or a master host computer.

PLCs. were able to move past simple on/off control to more complex schemes as PID control.

Applications Of SCADA

Almost every business in the manufacturing sector and many in the service sector

- Aerospace
- Bottling and Canning
- Chemicals Plants
- Petroleum, Petrochemical



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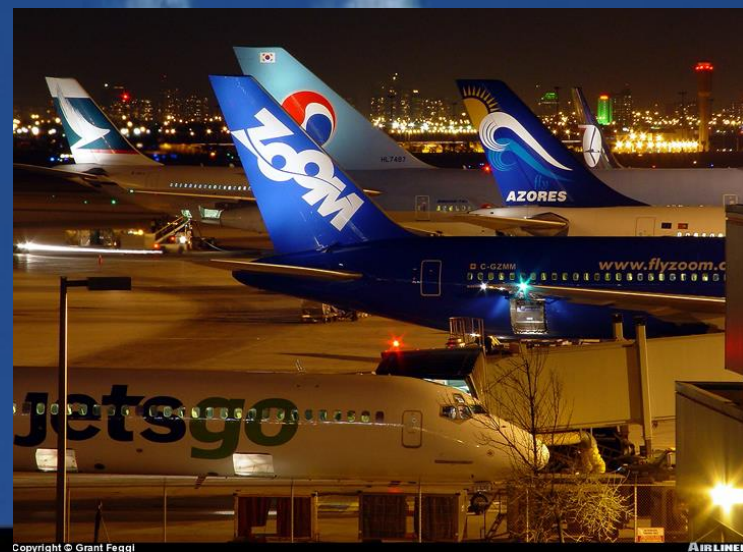
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TELEMETRY



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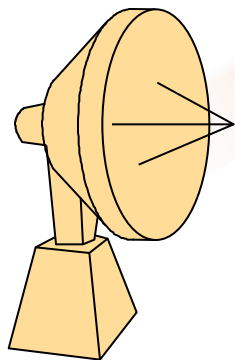
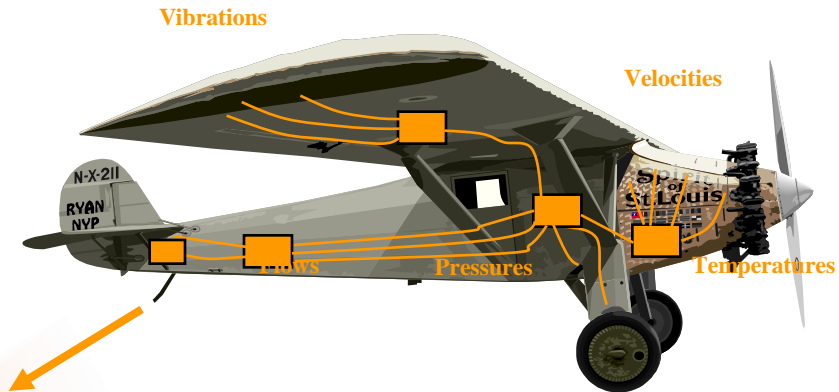
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What is Telemetry?

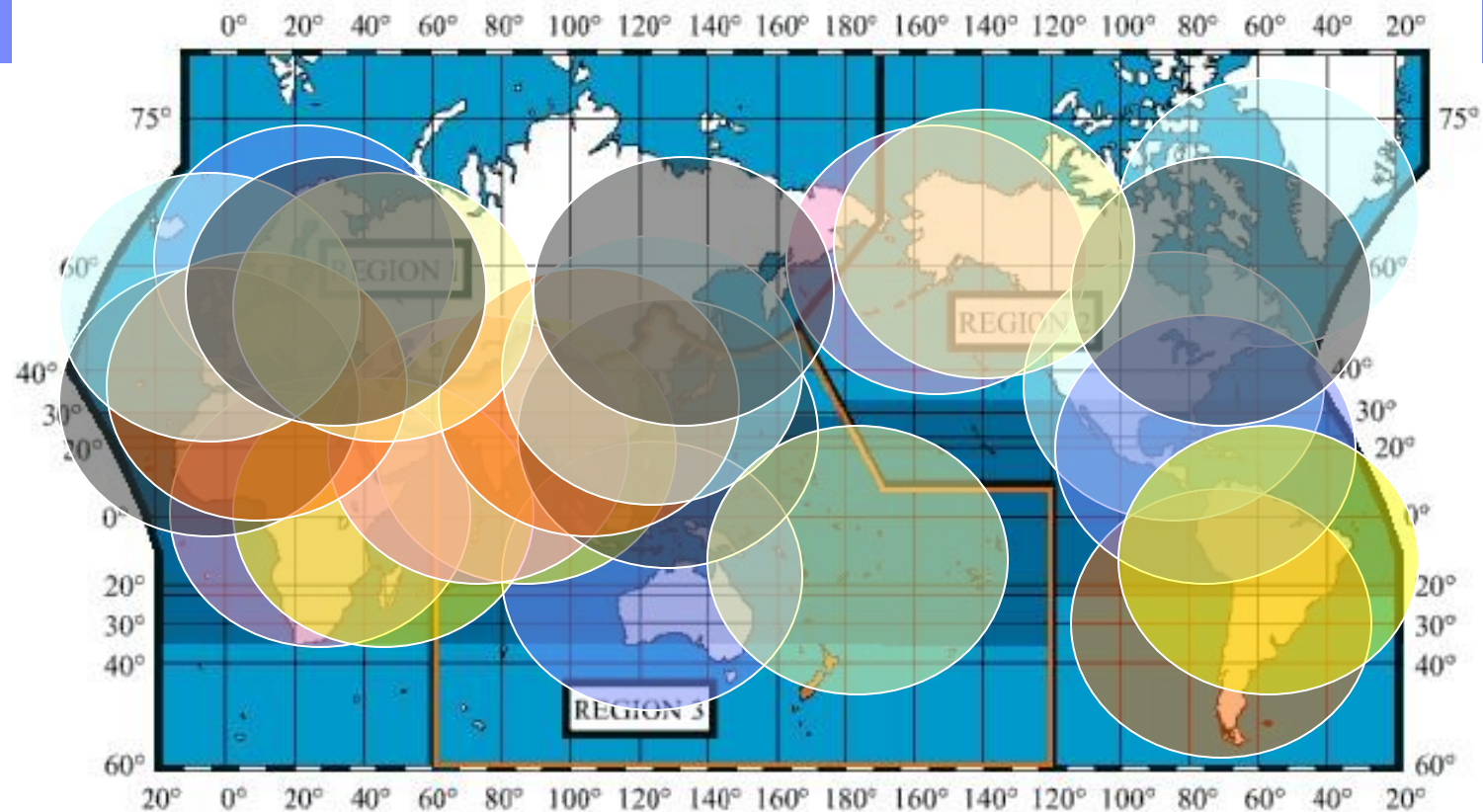
➤ Telemetry : The process of measuring at a distance.

➤ Aeronautical telemetry: The process of making measurements on an aeronautical vehicle and sending those measurements to a distant location for analysis



ORANGE

















Science and Telemetry Goes Global...



Region 1

	Kiruna, Sweden	
	Formosa Bay, Kenya	
	Coronie, Surinam	
	Biscarosse, France	
	Salto di Quirra, Sardinia	
	Aberporth, Wales	
	Zingst, Germany	
	Emba, Kazakhstan	

Region 2

	Tortuguero, Puerto Rico	
	Punta Lobos, Peru	
	Ft. Yukon, Alaska	
	NanOOSE Bay, Canada	
	Mar Chiquita, Argentina	
	Wallops, USA	
	Stromfjord, Greenland	
	Poker Flat, Alaska	

Telemetry Inevitable in Global Missions

Platforms on balloon, sounding rocket and UAV required for

In situ-measurements & calibration of satellite and ground borne instruments

Examples of important disciplines :

- Geophysics
Atmosphere, Land , Sea, Ice Research

- Biology
Animal behaviour & wildlife research

- Remote Medical Supervision
patient monitoring e.g. at expeditions („bush telemetry“)

Science Missions Requiring Wideband TM

Existing LEO-satellite data collection platforms only for narrow band data transmission (e.g. Argos, Orbcomm) available

Onboard storage capacity limited by space and weight, data compression & reduction of science data onboard critical

Data required on ground mostly in near-realtime

Therefore:

High-resolution science instruments, like imaging sensors, spectrometers, carried as Balloon, Sounding Rocket or UAV-payload need wideband telemetry links to fulfill their future missions

Water Quality | Environmental Protection

PETREL

B I O S E N S O R S



Petrel is
developing a
portable early-
warning system
to determine the
safety of water
resources



What is the problem addressed by the

Petrel Swimming Behavioral Spectrometer (SBS)?

- ▶ A wide range of readily available toxins exist for which rapid detection technology has not been developed or assessed
- ▶ SBS is a rapid, broad-spectrum detection system for:
 - Chemical toxins
 - Heavy metals
 - Organophosphates/pesticides , etc.
 - Bacterial toxins
 - Ricin
 - Anthrax
 - Botulinum
 - Radiation toxicity

Market Segments

- ▶ Municipal & private water supplies
- ▶ Homeland security
- ▶ Airlines, cruise ships...
- ▶ Military
 - Army: Field water supplies
 - Navy: all ships
- ▶ Wastewater treatment plants and receiving waters
- ▶ Industrial discharge monitoring
- ▶ Environmental runoff waters

End