Chapter 10: The Future of GIS

10.1 Why Speculate?

10.2 Future Data

10.3 Future Hardware

10.4 Future Software

10.5 Some Future Issues and Problems

Theme of the Course

- GIS's place in **understanding geographic distributions** and their mapping and prediction **in the real world**.
- So what does the **future** hold for GIS?
  - How might we see the **capabilities** you have already learned about **continuing to expand** in the future?

Speculating on GIS's Future is Useful Because …

- **Planning** for the purchase of hardware and software.
- Geographic information science, a new science that is used to **design future information systems**.
- **Expansion** into new fields and application areas.

So Why Speculate?

- May get something **right**!
- Most of tomorrow's systems are **under development now**.
- Some of tomorrow's systems **already exist**, but are not diffused through the hierarchy of potential users.

Compared to 10 Years Ago:

- **Acquiring data** for a new GIS is **no longer a major problem**.
- **GPS** has become a **major source** of new GIS data, and comes increasingly from **integrated GPS/GIS systems**.
- **Digital map images** such as scanned maps and air photos are often used as a background image for cross-layer registration and update.

Trends in GIS Data

- **Remote sensing** will become an (even more) important source of GIS data as **the cost of data falls** and new sorts of data arrive.
- **Data exchange** will become more common and has been **facilitated by exchange standards**.

Major Influences on GIS

- Advanced GIS work has been influenced significantly by the **workstation / powerful PC**.
- GIS has quickly incorporated **distributed systems and databases**.
- The **microcomputer** has allowed GIS to be **applied to new fields** and has **improved GIS education**.
- The **mobility** of portable GIS and GPS systems has revolutionized GIS use.

GIS Improvements

- Improvements in the **user interface** have substantially altered GIS "look and feel."
- Basic data differences such as raster vs. vector have **disappeared** as GISs have become **more flexible**.
- **Object-oriented programming** and databases are likely to improve GIS.
- GIS software is now **easier to install and maintain**.

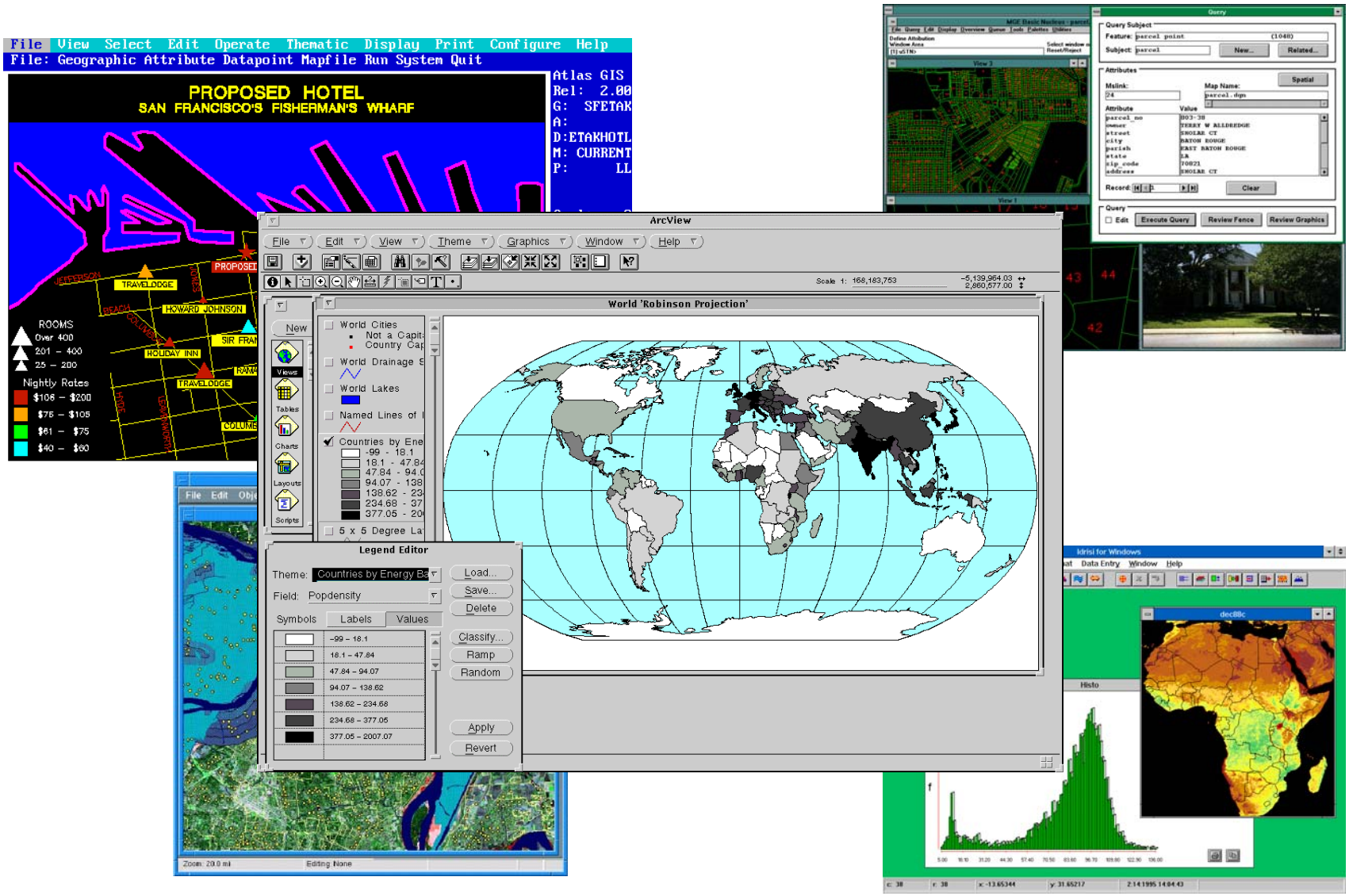
GIS Trends

- Many GIS databases are now **distributed** over local or wide area networks.
- **Multimedia and hypermedia** will play a growing role in GIS, especially in help and training systems.

Some of the Future is NOW!

- Desktop mapping. "**Business Geographics**."
- Real **high end power**.
- GIS/GPS **integration**.
- **Rapidly maturing market** with broad public acceptance and knowledge
- **The Web**. More than data delivery.

Desktop Mapping



In-Vehicle Navigation Systems

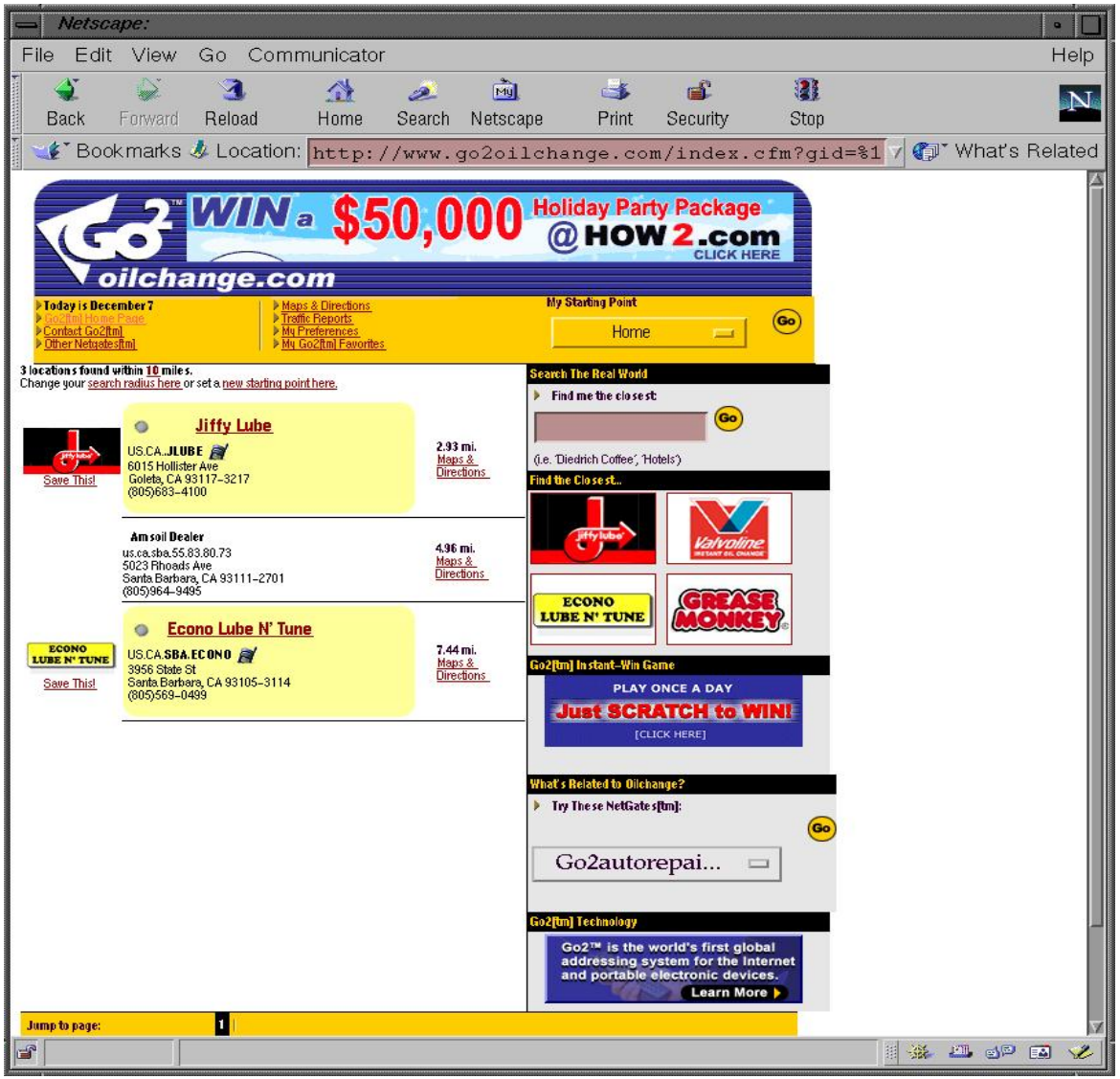
GIS/GPS Integration

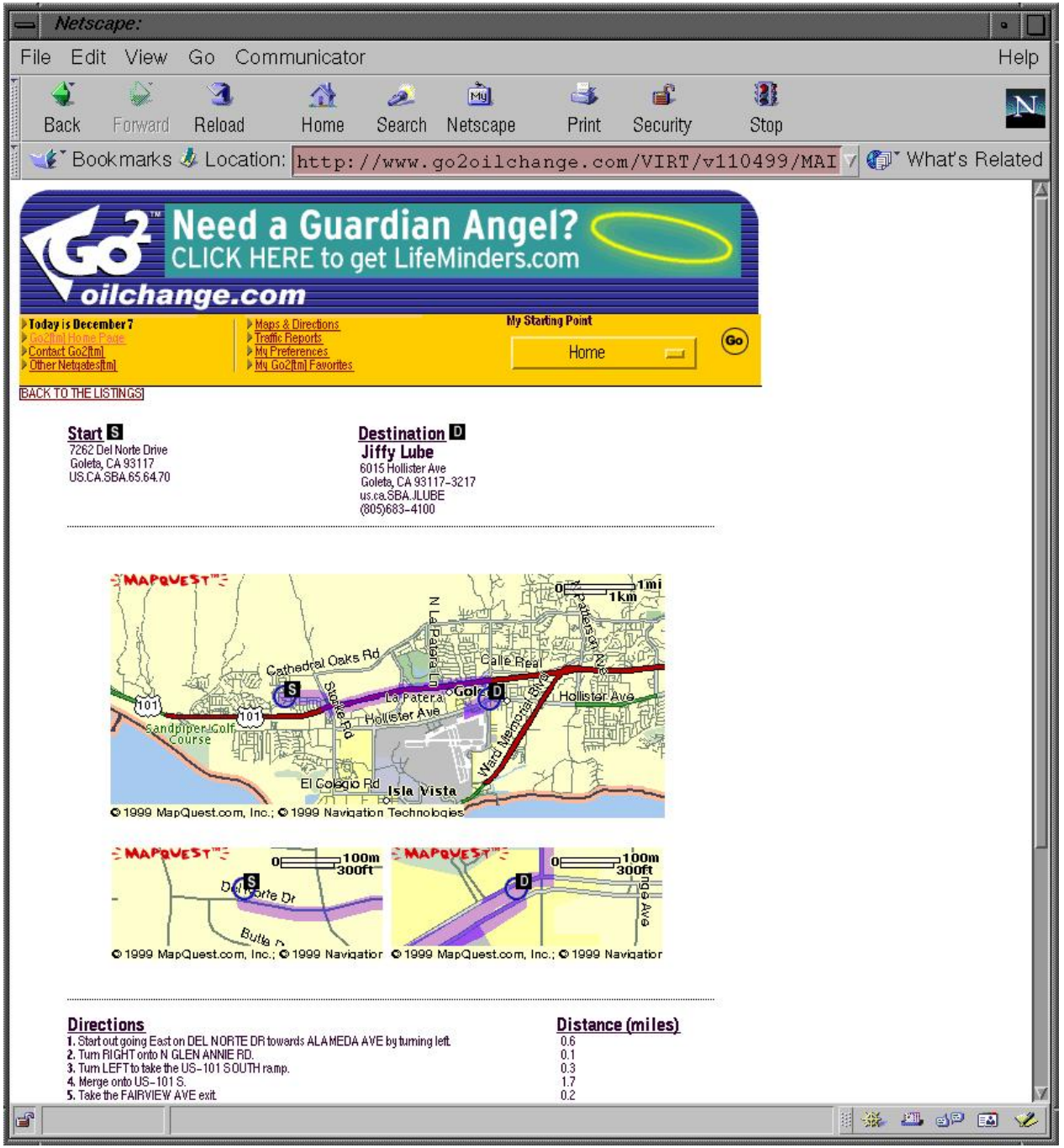
The Apple iPhone 3G with GPS

The Web:

Beyond data, metadata, toward information

Geographic Web-Searching

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Directions
1. Start out going East on DEL NORTE DR towards ALAMEDA AVE by turning left.
2. Turn RIGHT onto N GLEN ANNIE RD.
3. Turn LEFT to take the US-101 SOUTH ramp.
4. Merge onto US-101 S.
5. Take the FAIRVIEW AVE exit.
Distance (miles)
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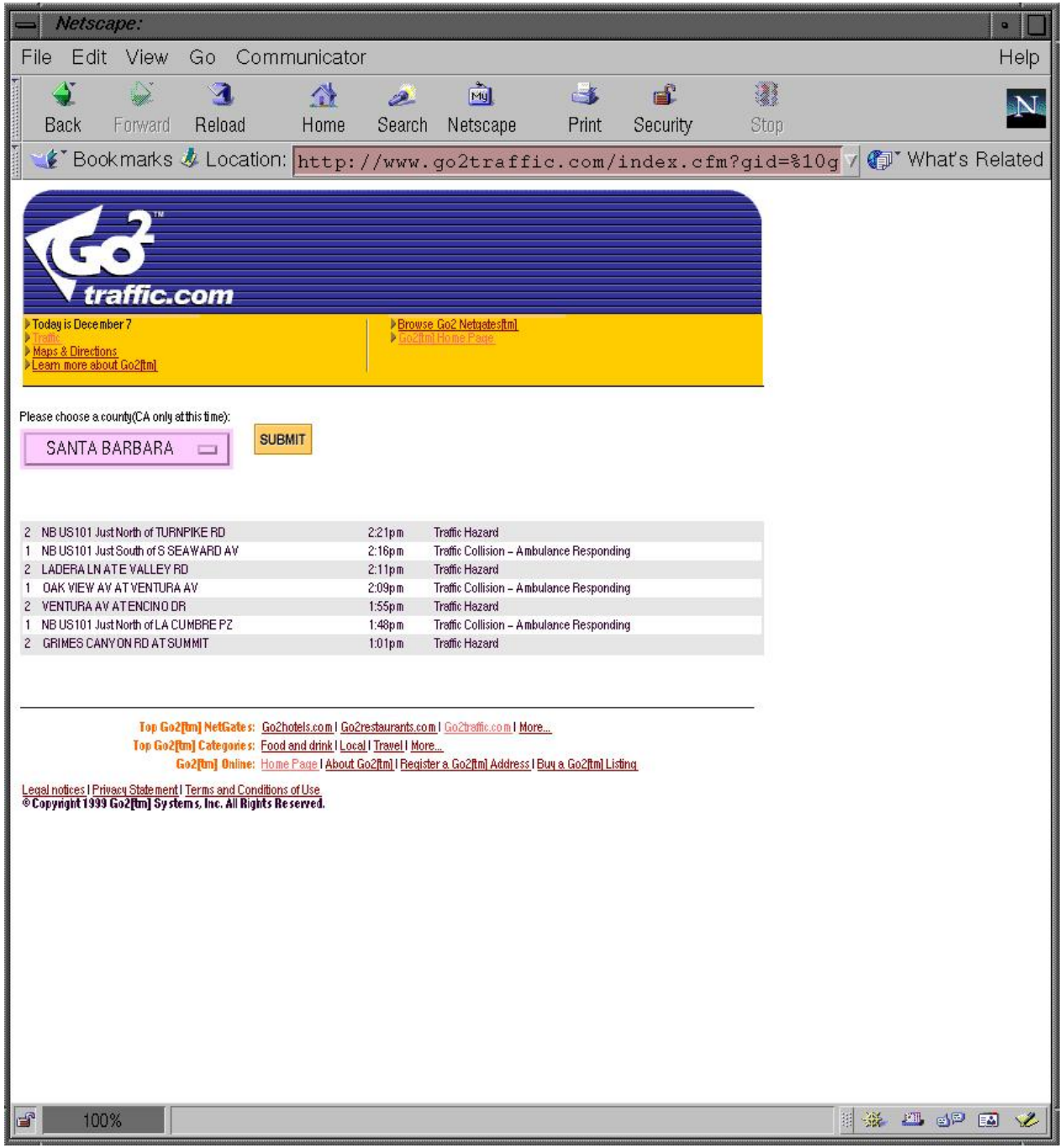
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SUBMIT
2 NB US101 Just North of TURNPIKE RD 2:21pm Traffic Hazard
1 NB US101 Just South of S SEAWARD AV 2:16pm Traffic Collision – Ambulance Responding
2 LADERA LN AT E VALLEY RD 2:11pm Traffic Hazard
1 OAK VIEW AV AT VENTURA AV 2:09pm Traffic Collision – Ambulance Responding
2 VENTURA AV AT ENCINO DR 1:55pm Traffic Hazard
1 NB US101 Just North of LA CUMBRE PZ 1:48pm Traffic Collision – Ambulance Responding
2 GRIMES CANYON RD AT SUMMIT 1:01pm Traffic Hazard
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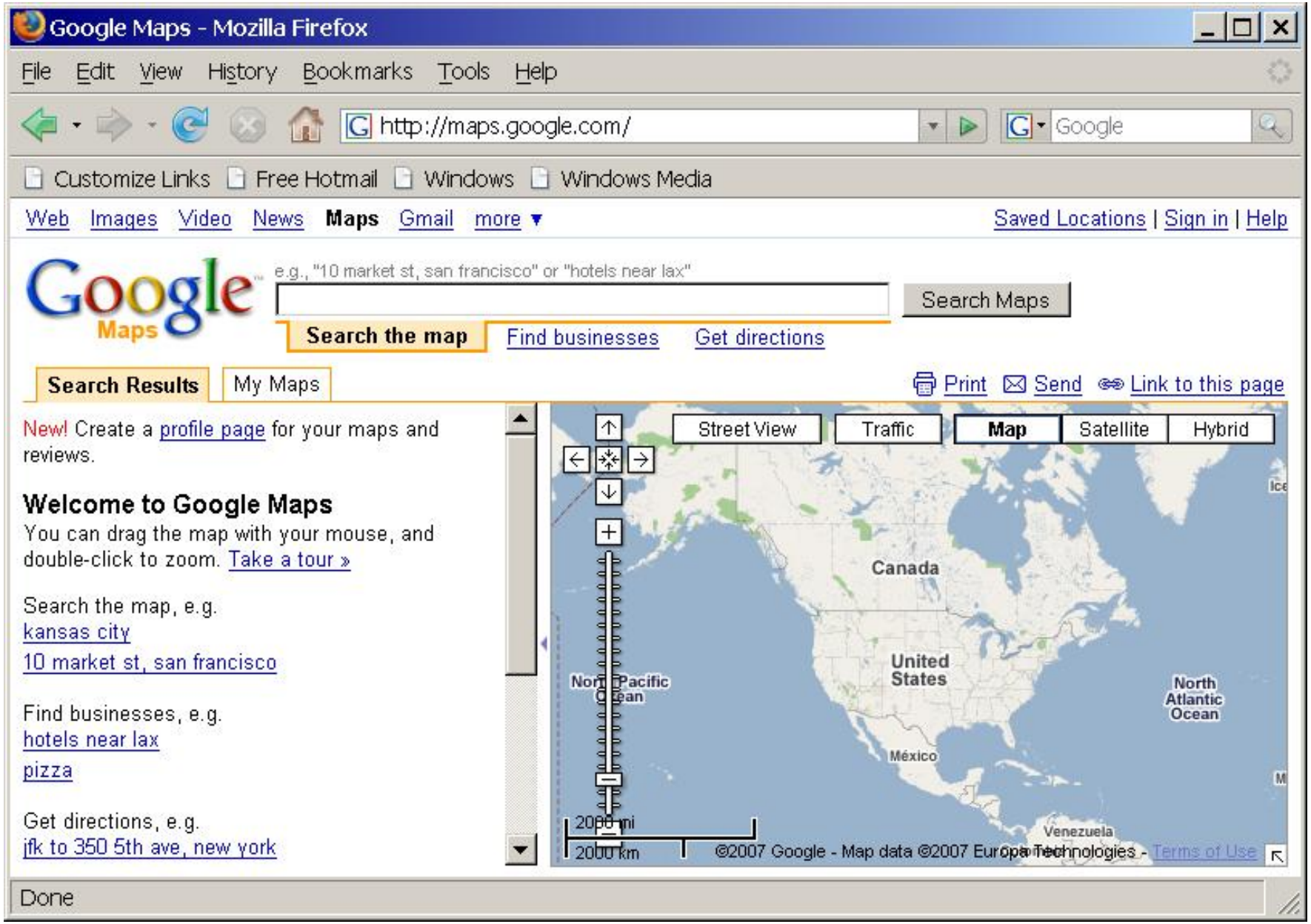
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Search the map Find businesses Get directions
Search Results My Maps
Print Send Link to this page
New! Create a profile page for your maps and reviews.
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10 market st, san francisco
Find businesses, e.g.
hotels near lax
pizza
Get directions, e.g.
jfk to 350 5th ave, new york
Street View Traffic Map Satellite Hybrid
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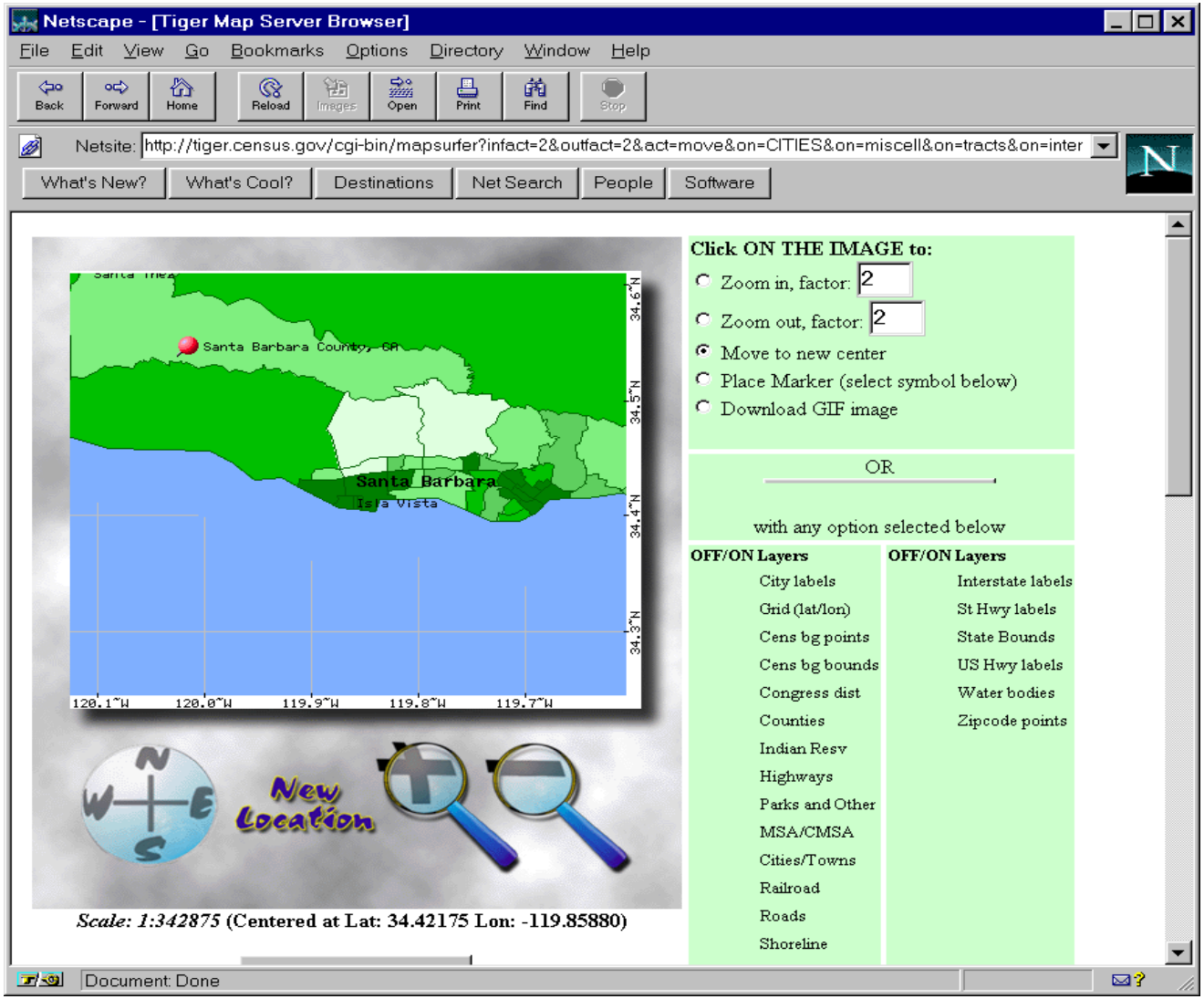
The Web:

TMS from the census bureau



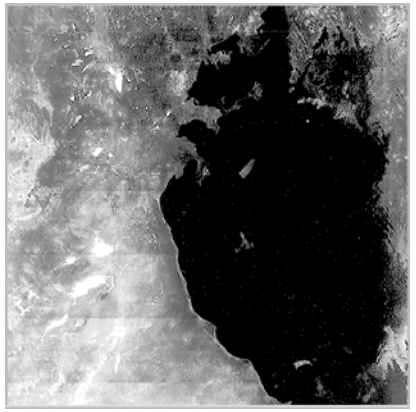
The Four Revolutions

- Workstation
- Microcomputer
- Network
- Mobility

Future Data

- DOQ
- DRG
- EOS (MODIS)
- Landsat 7
- SPOT
- Radarsat
- CORONA

- Commercial 1-5 meter
- GPS to GIS
- NSDI: Local sharing



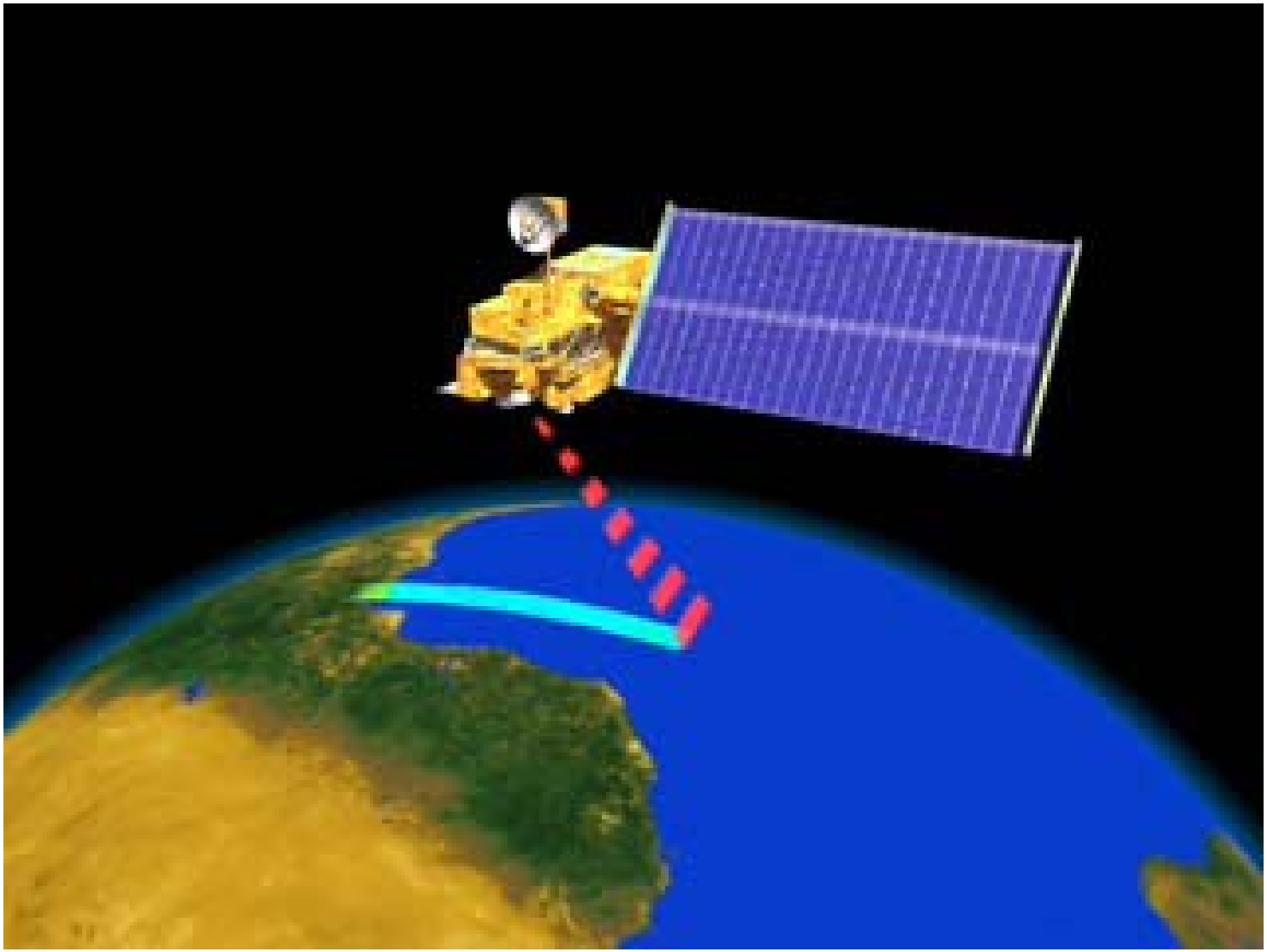
MODIS

•**MODIS (Moderate Resolution Imaging Spectrometer)** is a project being run by NASA, in partnership with the USGS (US Geological Survey)

•The MODIS sensors are the 'centerpiece' sensors on two new satellites that have been called Earth Observing Systems (EOS-AM and EOS-PM), codenamed **Terra and Aqua**

•**Terra** was designed to focus on land-based applications and has an equatorial **overpass time of about 10:30 AM**, while **Aqua** was designed for more sea-oriented applications and has an equatorial **overpass time of about 2:30 PM**, and the MODIS sensors on them are known as MODIS-AM and MODIS-PM

MODIS



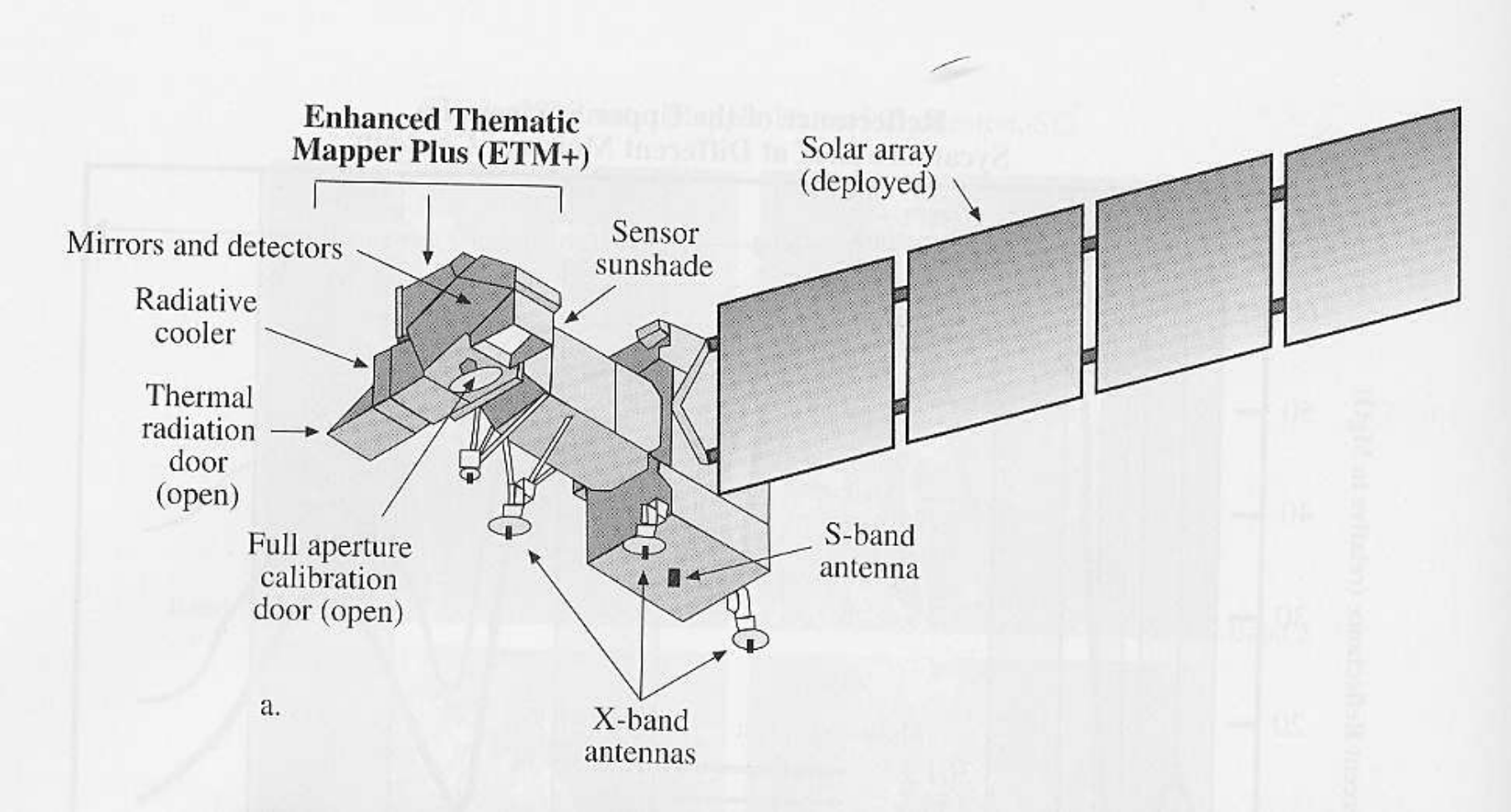
The Landsat Series of Satellites

•While early applications of remote sensing were developed for military use, those technologies are now of **benefit to society** in many other applications, including environmental research

•On **July 23, 1972**, the first remote sensing satellite designed to collect satellite imagery throughout the globe for research purposes -- the Earth Resource Satellite -- was launched. This satellite was later renamed **Landsat**. The Landsat series of satellites continues to be used today (now up to Landsat 7)

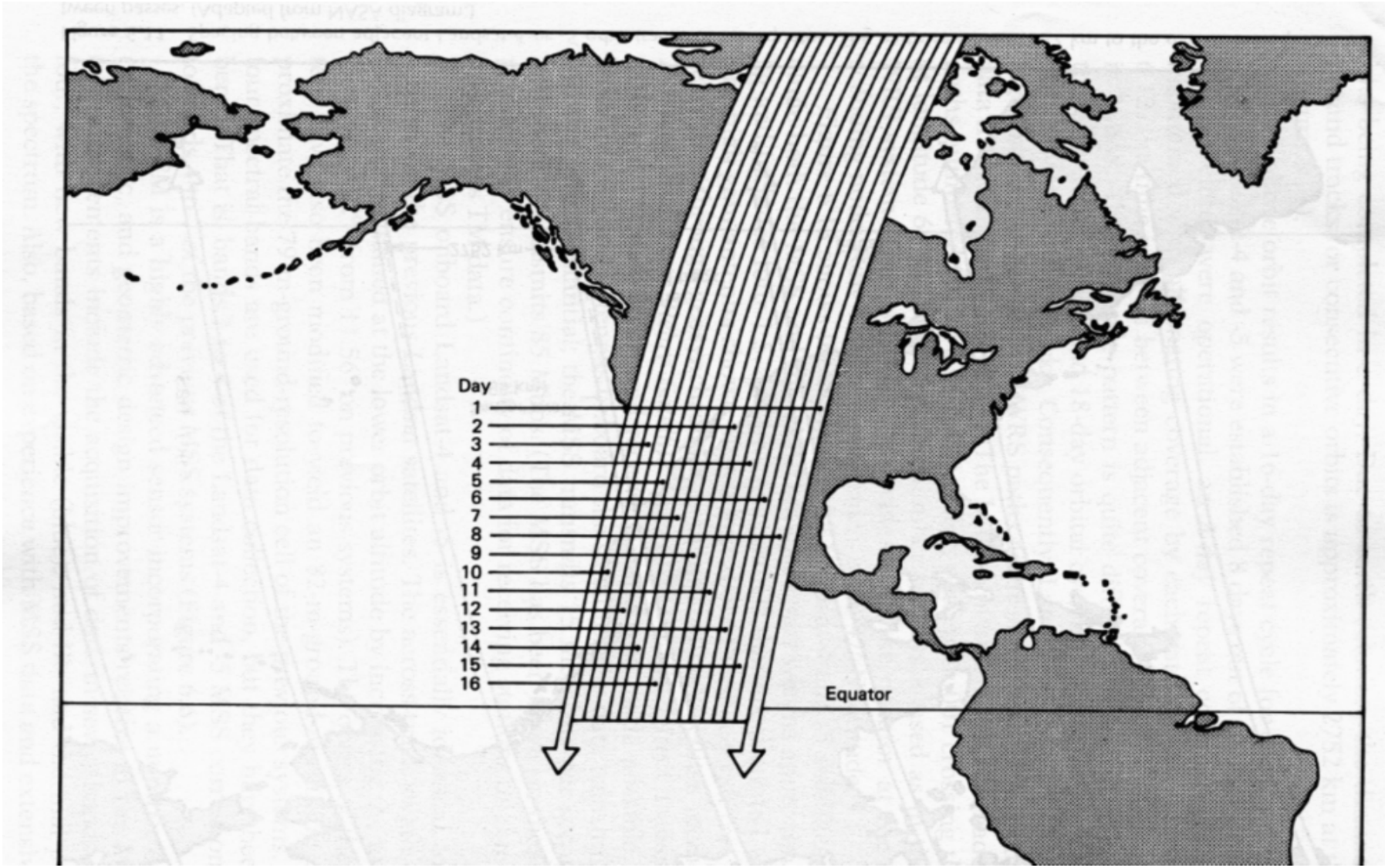
•While successive satellites in the series had more **advanced sensors** aboard, an effort was made to maintain some **continuity** in both the sensors' characteristics (e.g. their spatial, spectral, temporal, and radiometric resolutions) so that data collected from sensors aboard new **platforms** could be compared reasonably to older data

Landsat (6 and) 7

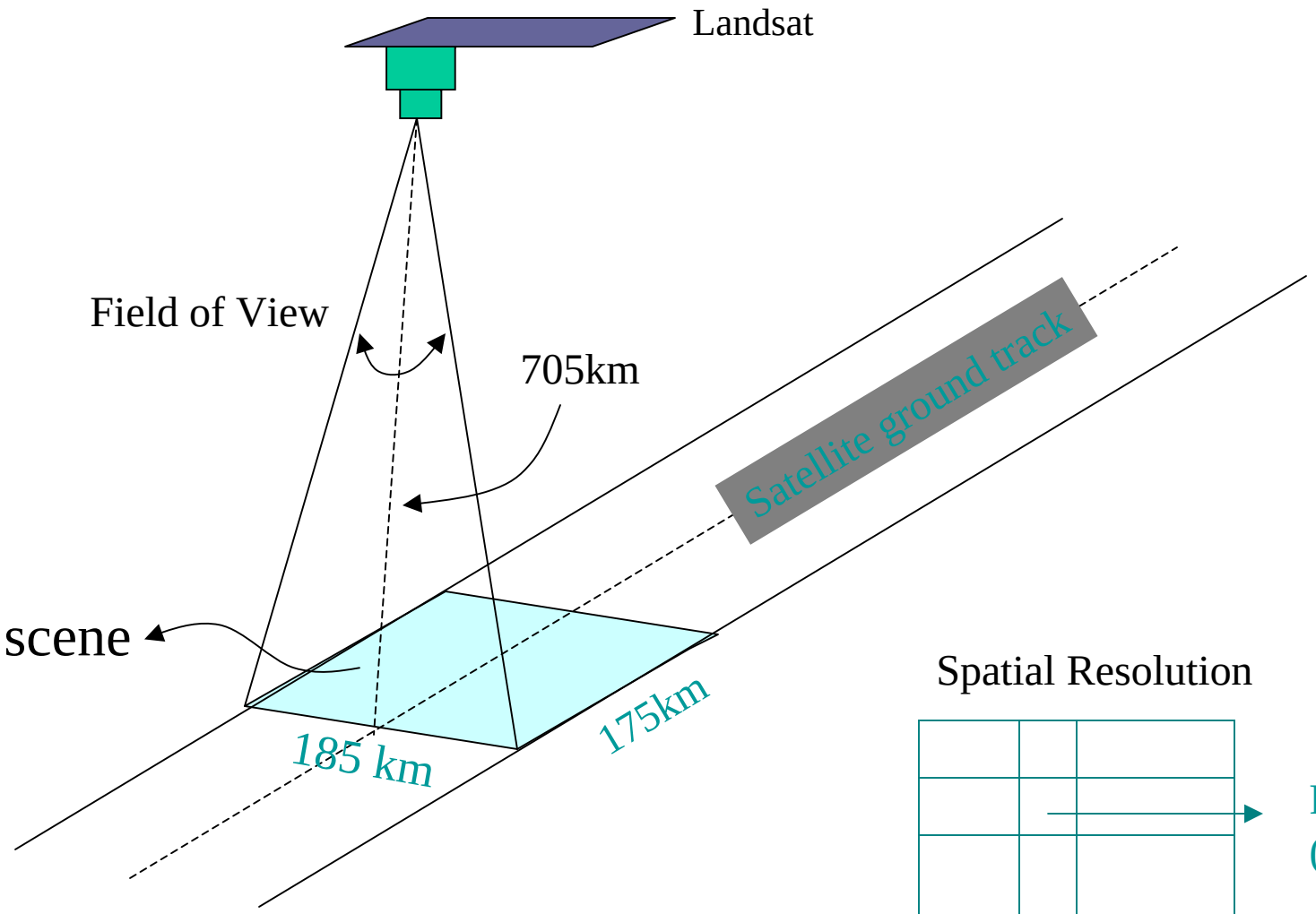


ETM+ Enhanced Thematic Mapper Plus ~30m pixels

Landsat Temporal Resolution



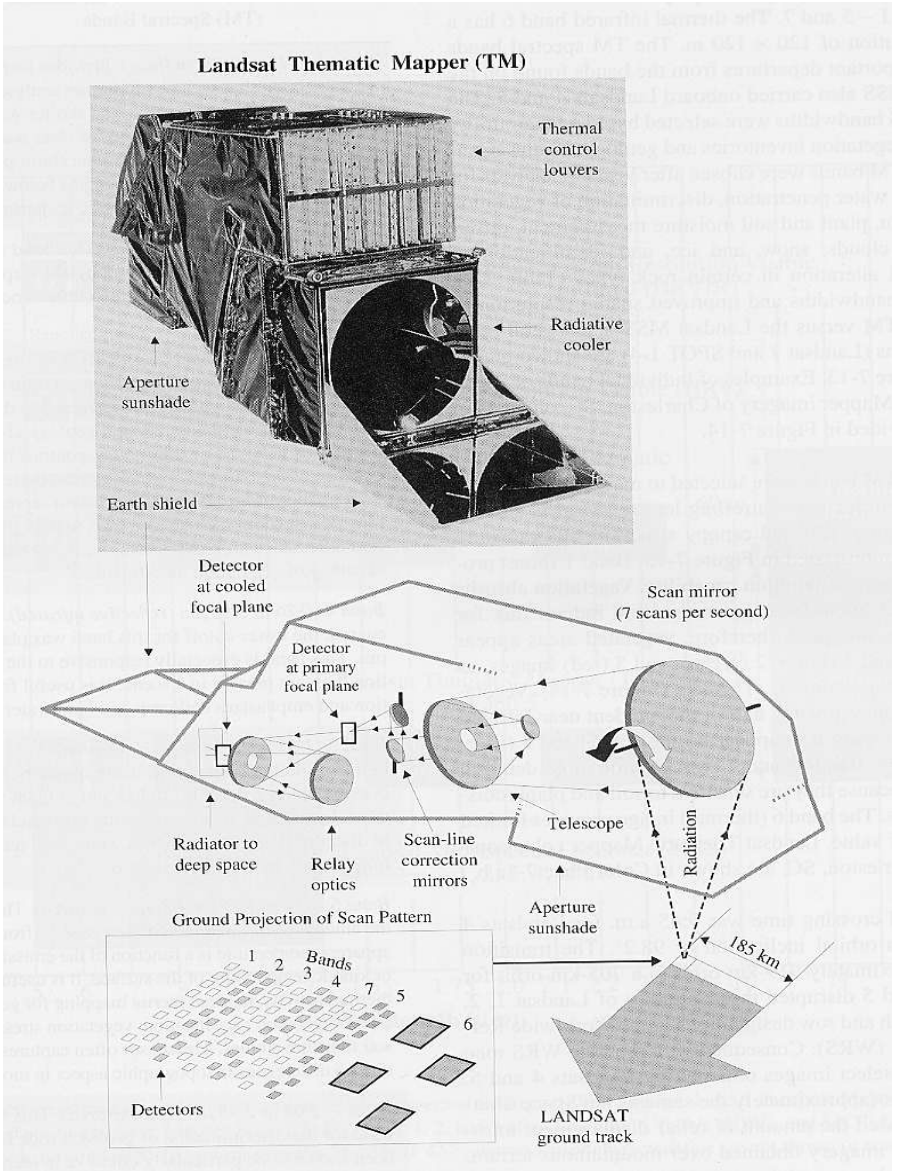
Landsat TM Swath Width

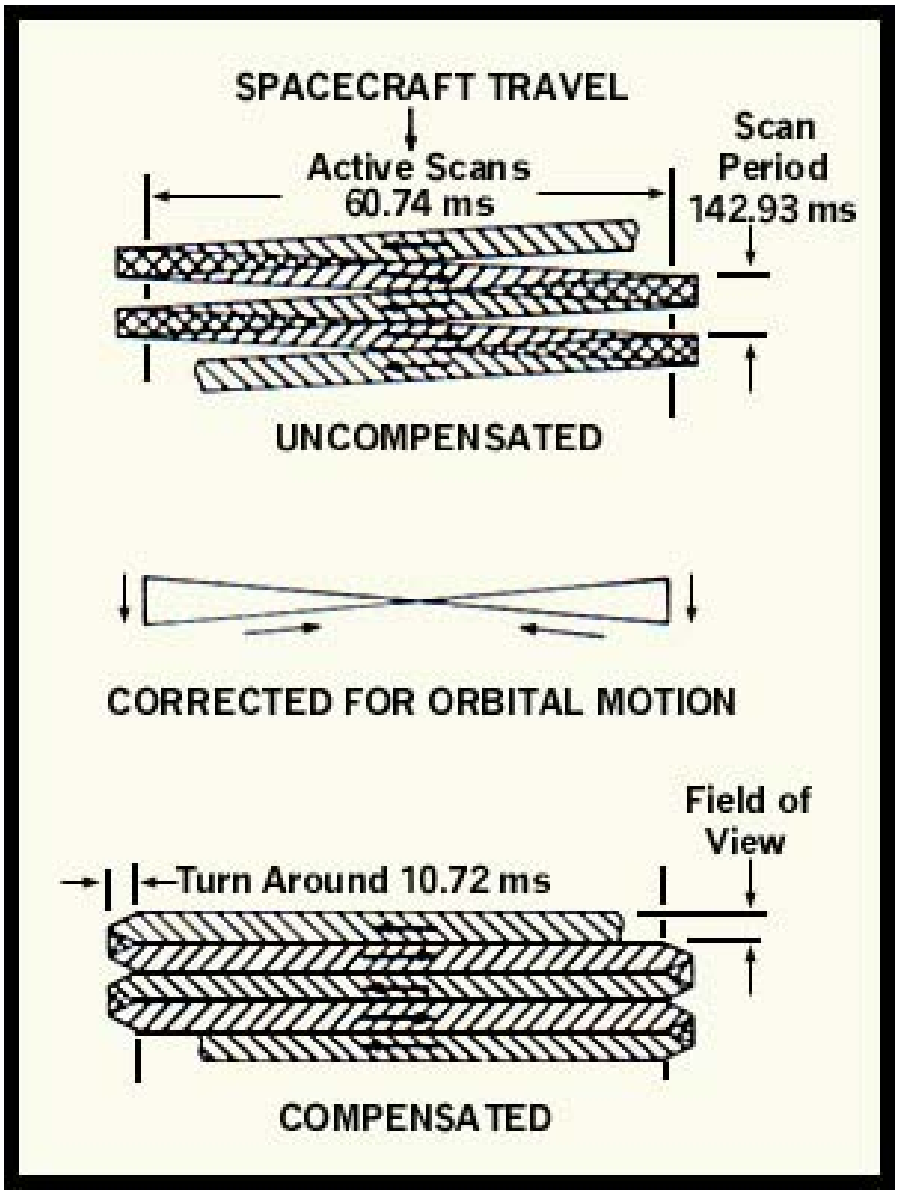


Spatial Resolution

Pixel size=
(30x30m)

The Thematic Mapper Sensor



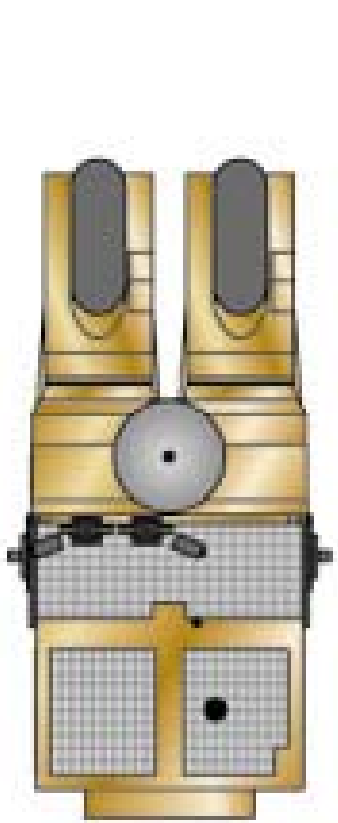


http://ltpwww.gsfc.nasa.gov/IAS/handbook/handbook_htmls/chapter13/htmls/slc.html ^

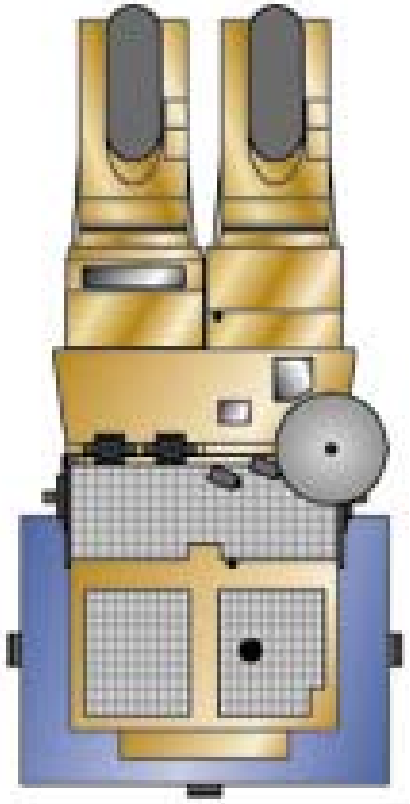
The SPOT Series of Satellites

- The United States' work with the Landsat series of satellites is **not the sole example** of a series of space-based satellite platforms that were developed to house multi-spectral scanning sensors designed to image the whole of the globe
- While the Landsat satellites in the 1970's were certainly the pioneering effort of this type, France soon followed suit with its **SPOT** (Systeme Pour L'Observation de la Terre - translation: System for Earth Observation) program
- SPOT 1 was launched in early 1986, and used some slightly different approaches to achieve **higher spatial resolutions** and **flexibility in image targeting** which the Landsat program did not achieve

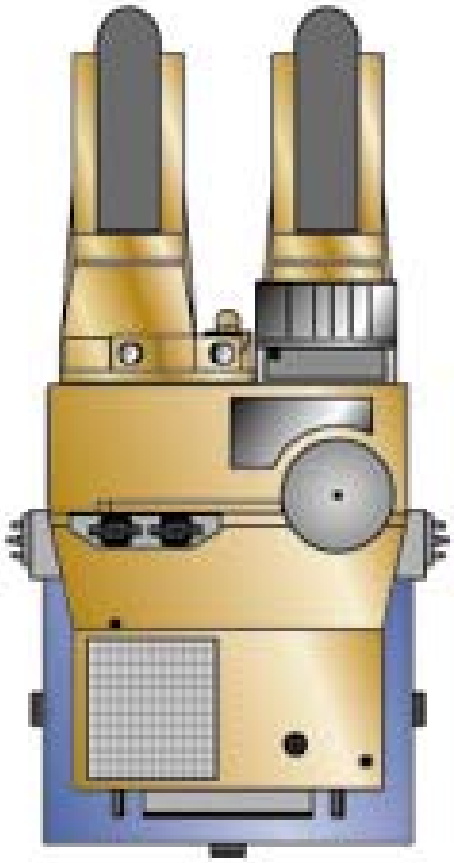
SPOT Platforms



Spot 1, 2, 3



Spot 4



Spot 5

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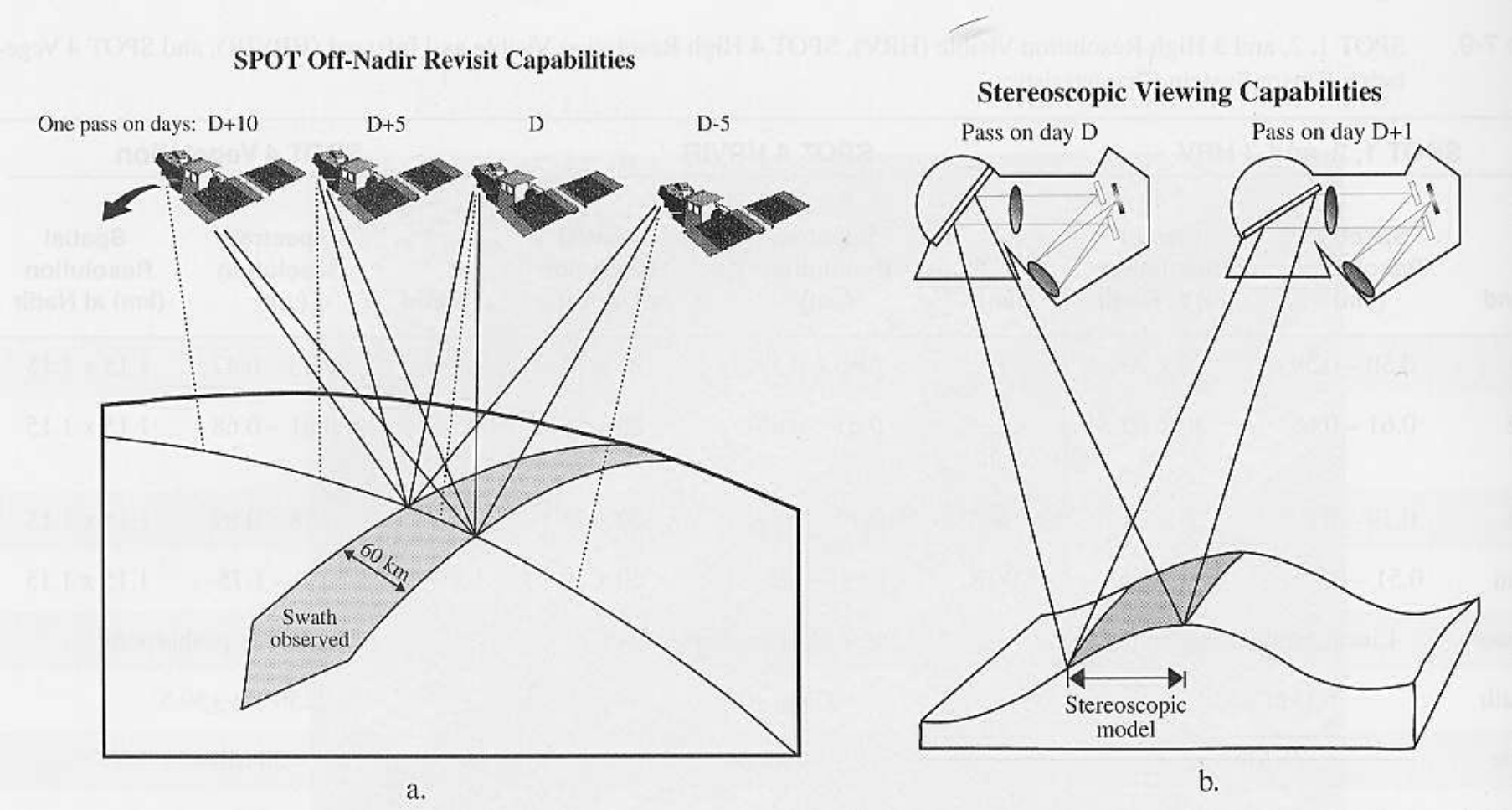
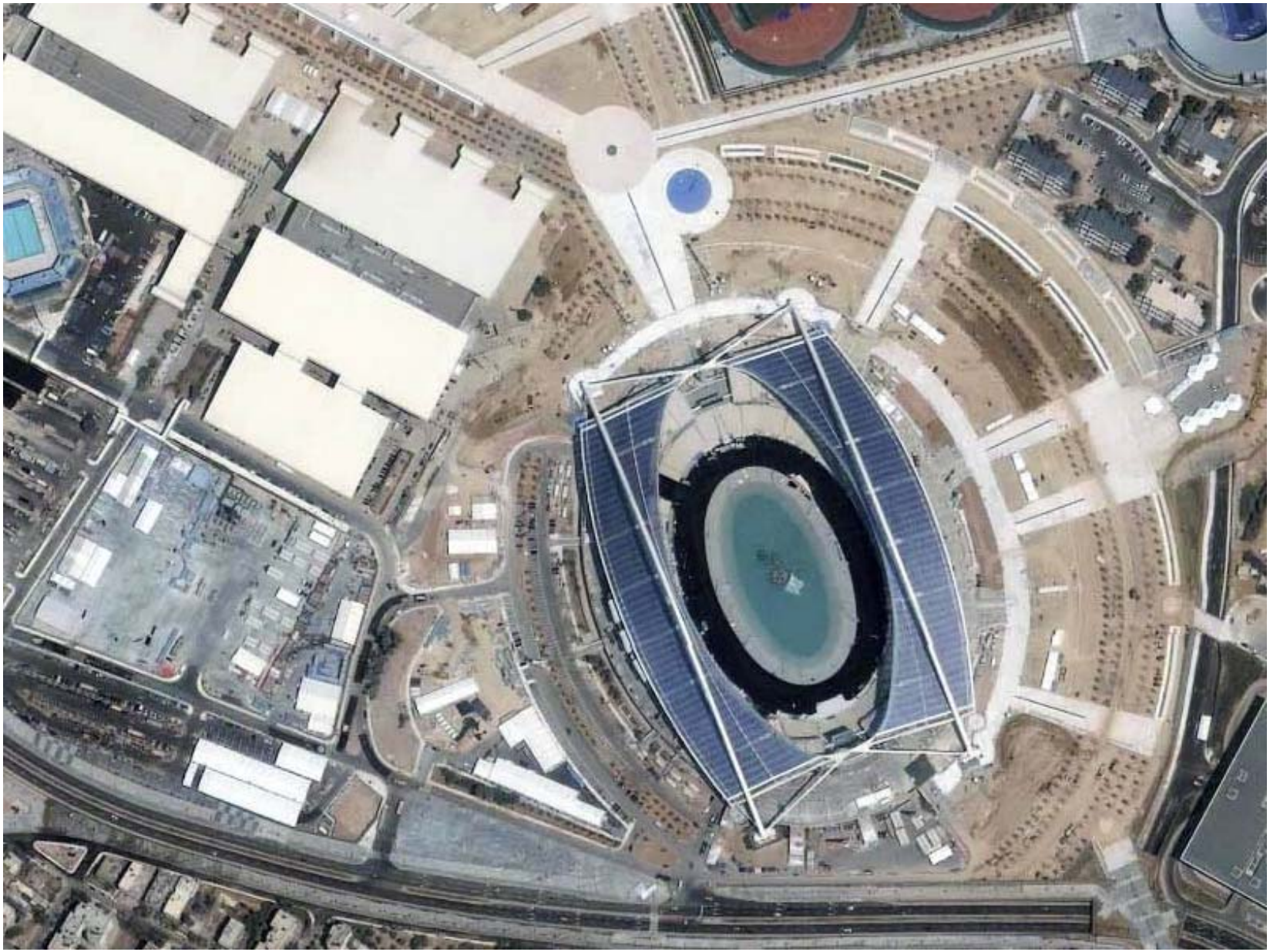
Pointable SPOT Sensors



Ikonos Image - Athens Olympic Sports Complex



July 24, 2004

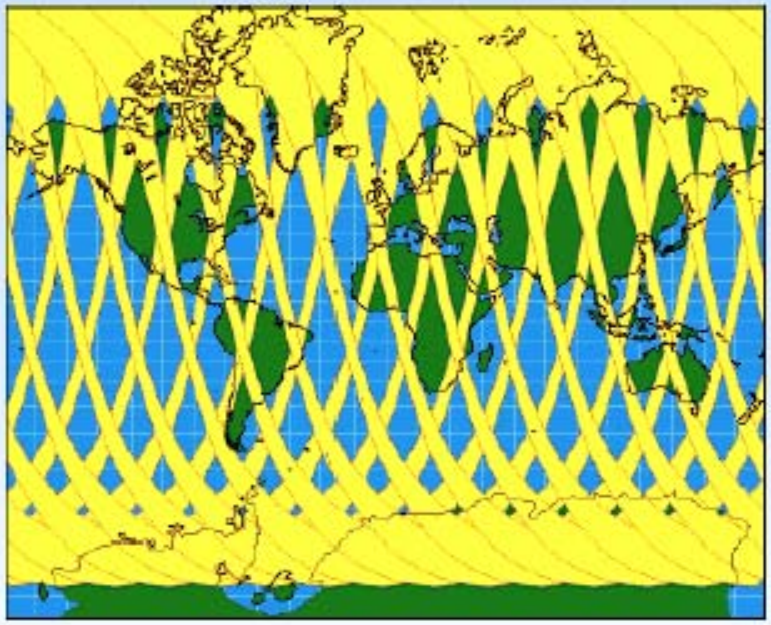
Quickbird Image - Athens Olympic Sports Complex

August 23, 2004

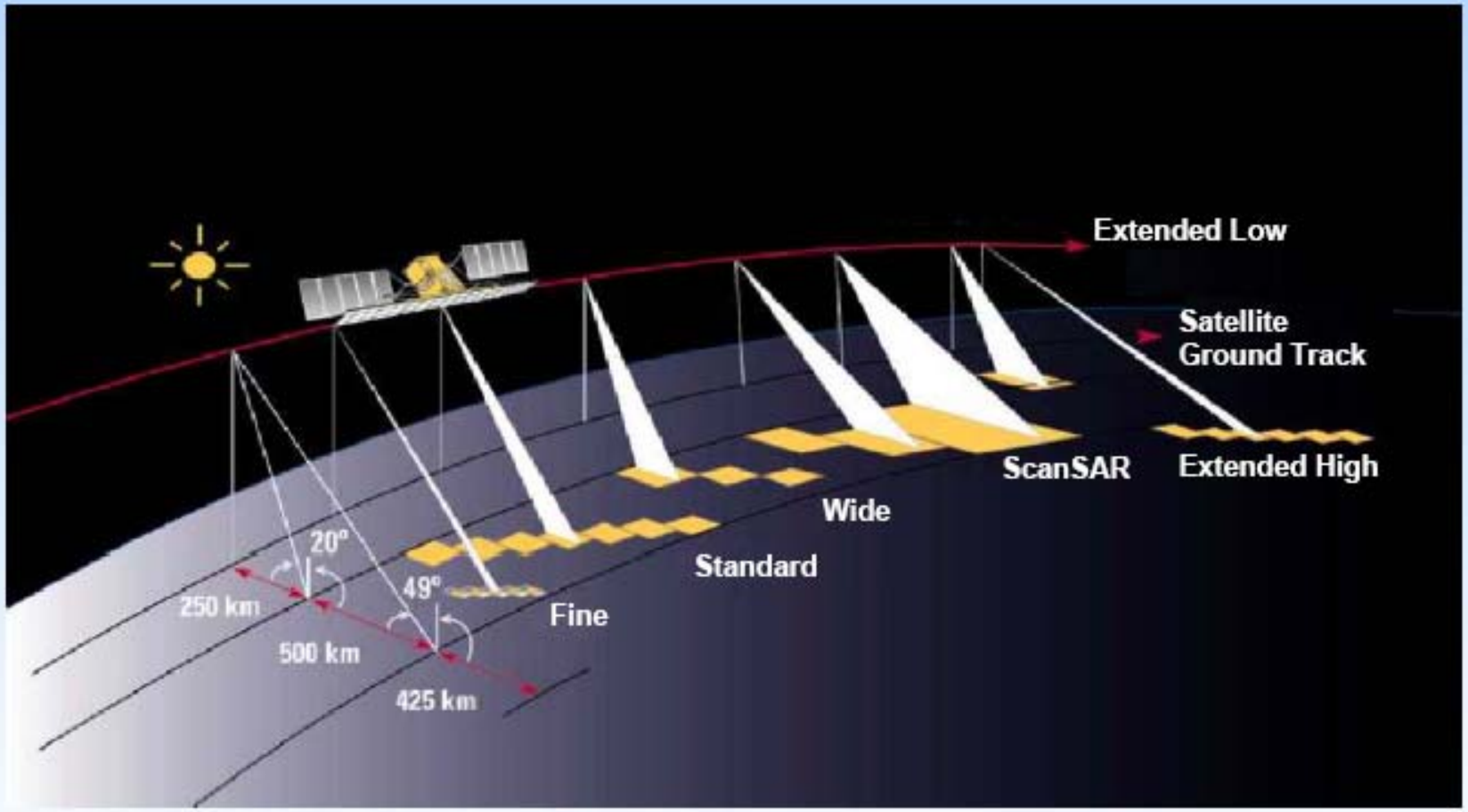
RADARSAT-1

RADARSAT-1 Coverage

RADARSAT can provide complete global coverage with the flexibility to support specific requirements. The satellite's ground track is repeated every 24 days. RADARSAT can provide daily coverage of the Arctic, view any part of Canada within three days, and achieve complete coverage at equatorial latitudes every six days using a 500 kilometre wide swath.



SAR Imaging Modes of RADARSAT-1



Future Data Distribution: On Demand, at Time of Use

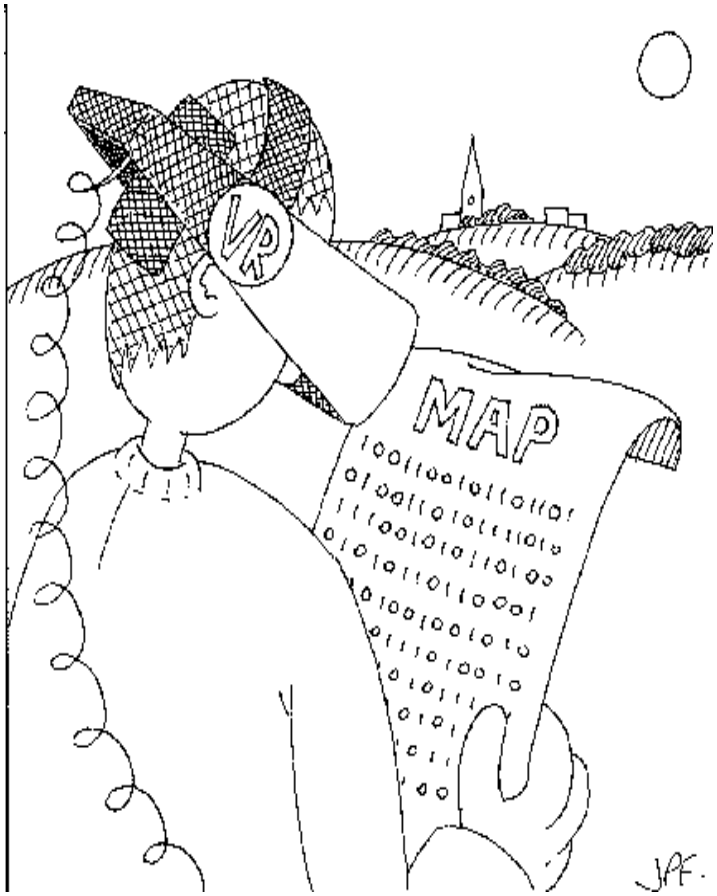
- NASA's EOSDIS: The DAACs
- Project Alexandria
- Vendors
- Census 2000

Future Software

- **Scientific visualization** tools
- **Automated vision** tools
- **Fourth** dimension
- **Spatial analysis** tools
- **Hyperinteractivity**
  - Multisensory input
  - Multisensory output

Hyperinteractivity

- Input
  - Touch
    - Gloves
    - Sensors
  - Sight
    - Vision tracking
    - Cameras
- **GIS as clothing**
- **GIS via the Web**
  - Moving
  - Static

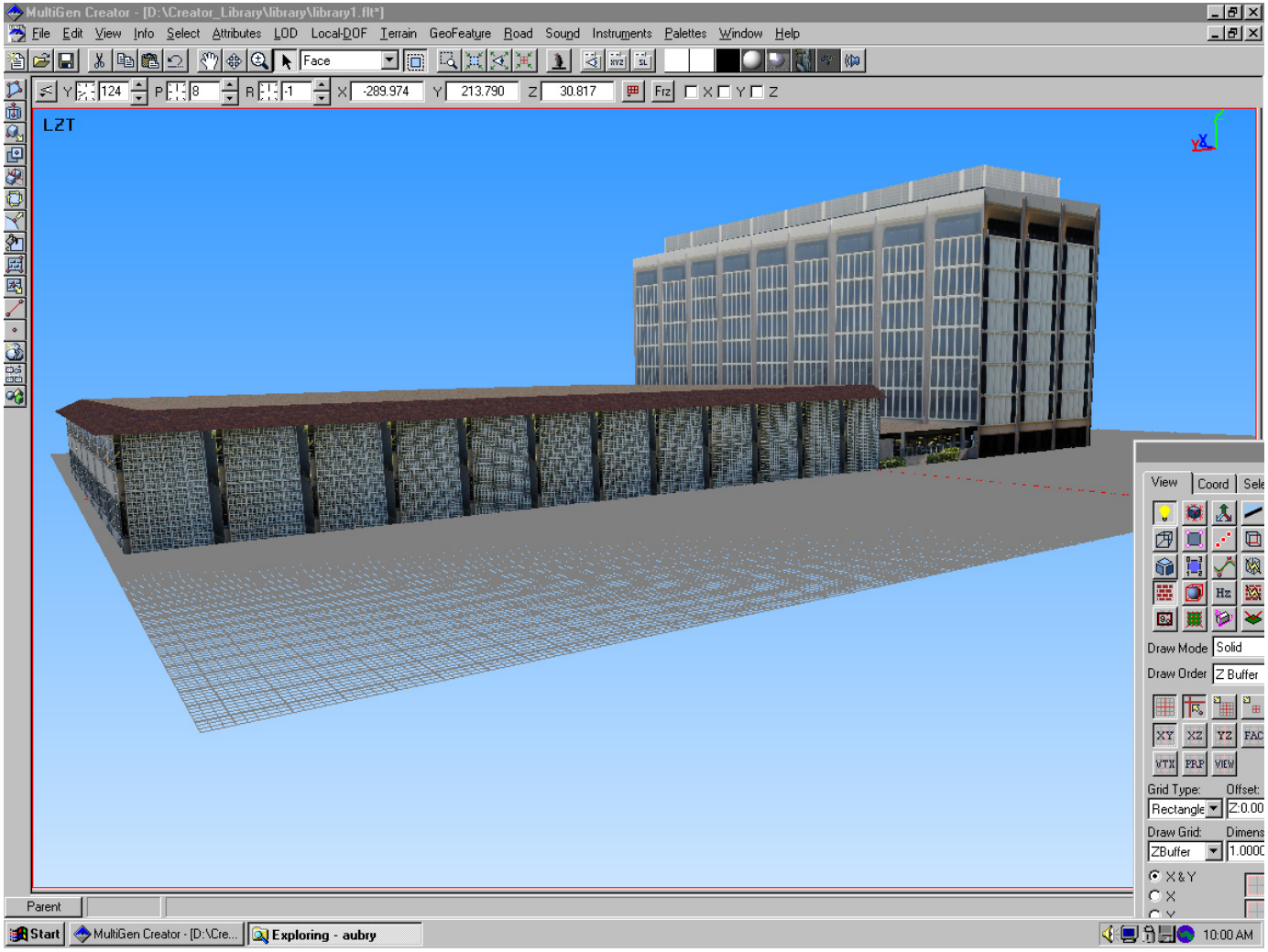


Wearable Computers Come of Age

Future GISs

- Scientific visualization and computer graphics will be **increasingly integrated** with GIS capabilities
- **Animated** maps
- **Interactive** maps
- **Augmented** reality

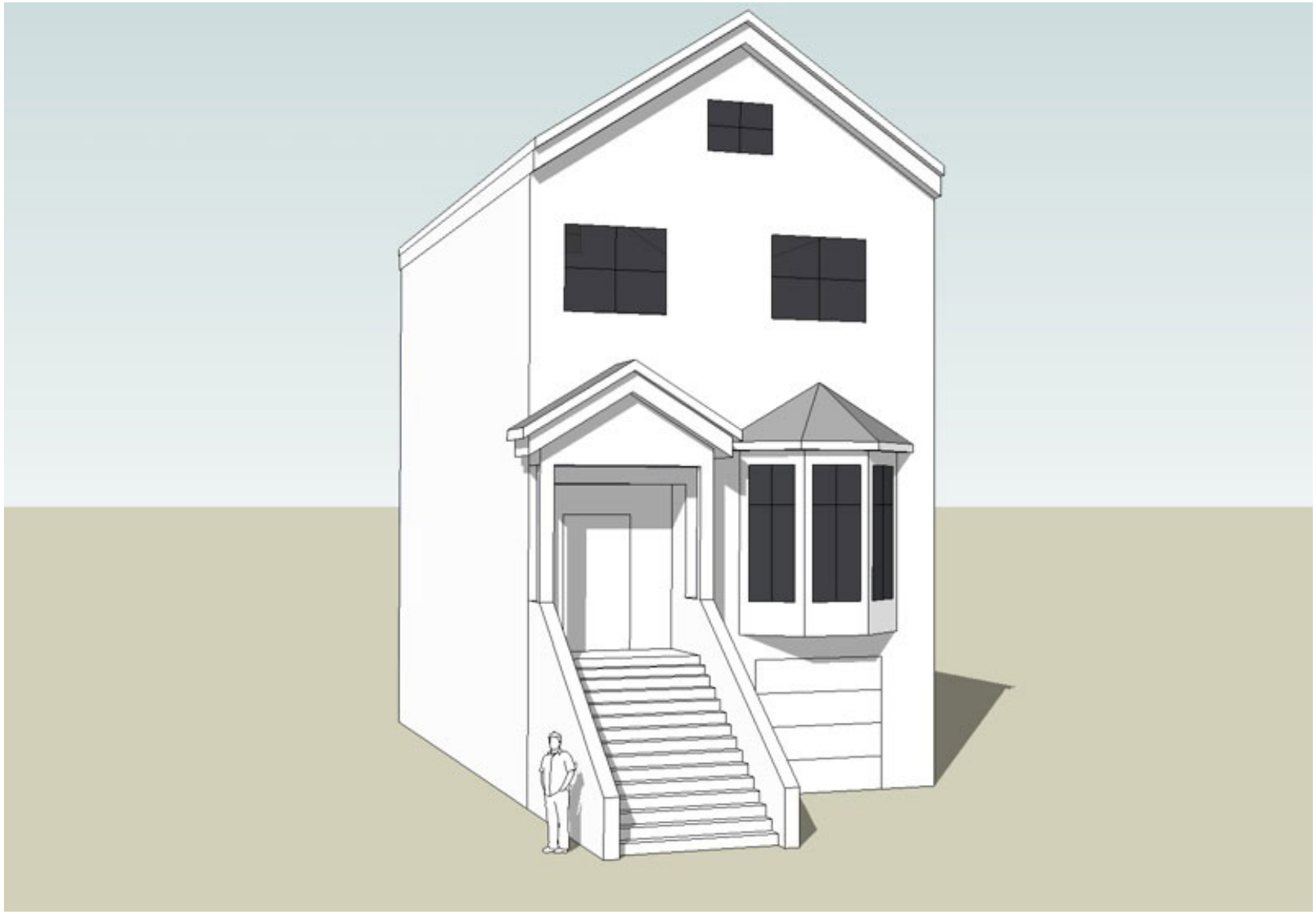
Future Environments - VRML



Google Earth / SketchUp Example 1

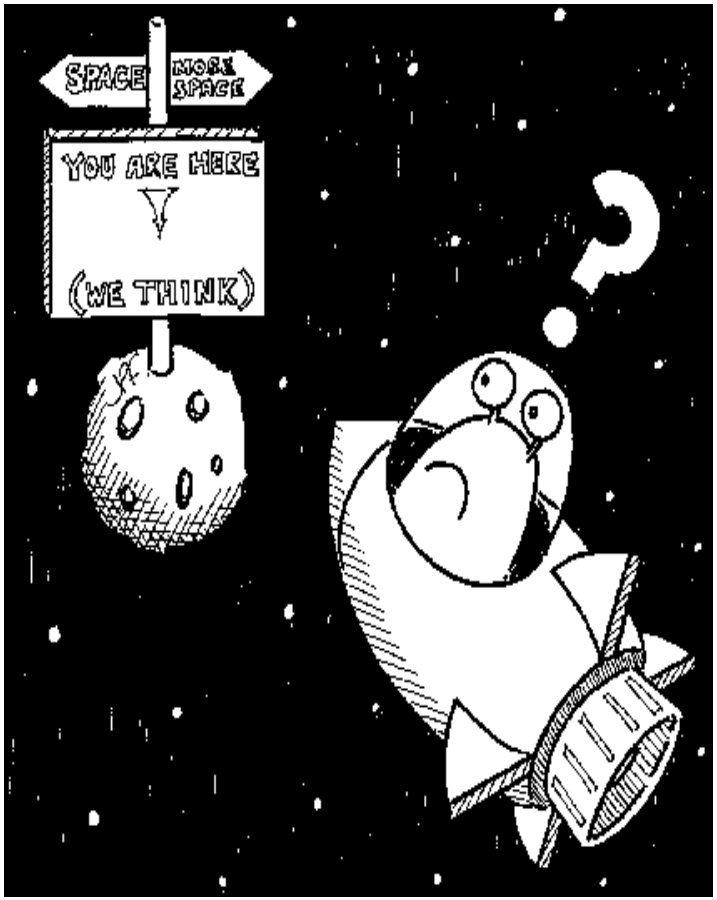
Google Earth / SketchUp Example 2

Google Earth / SketchUp Example 3



Future Issues

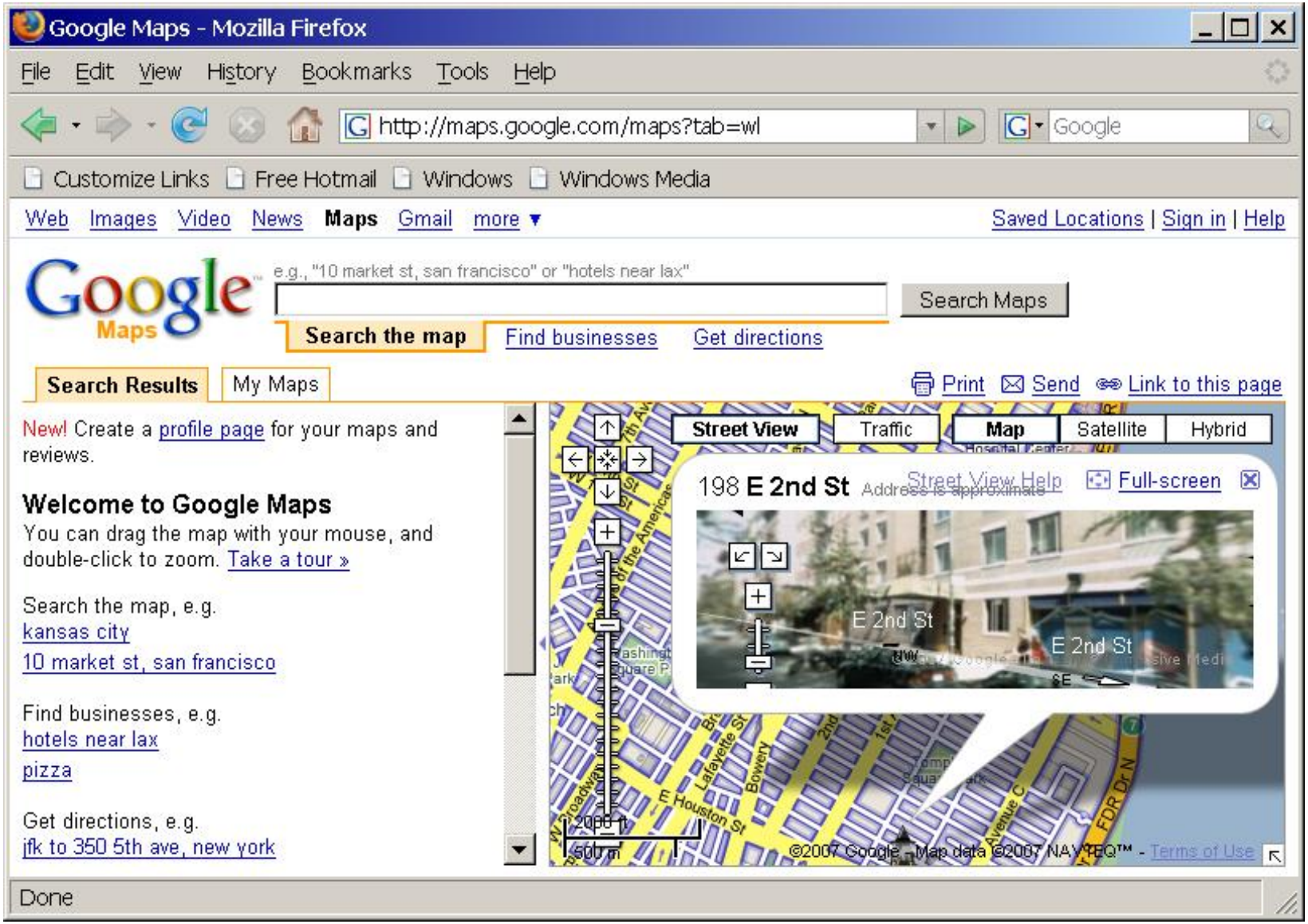
- New users
- Privacy
- Data ownership
- GI Science & Technology



New User Communities

- Archeology
- Epidemiology
- Law
- K-12 Education
- etc.
  - **Simpler** systems?
  - **Specialty** systems?

Privacy? Google Maps StreetView …



Data Ownership

- **FOIA** is only in the US, not global
- **Copyright and publishing** (Bits not atoms)
- Global data **inequalities**
- The **Bit Police**?

GIS R & D

- GIS user needs are both for **small one-person** systems and **large multi-person** systems.
- GIS software **research is active** and continues to **build new developments**.
- GIS will become **increasingly interoperable** as concepts, user interfaces, and functions become **more standardized**.

Future Issues

- **Privacy** will become a **critical issue** for GIS as use expands to **legal applications**.
- **Data ownership** will remain **critical** to GIS, with a **delicate balance** between public and private GIS data.
- GIS research is threatened by a **lack of funding** and should be protected by the GIS community.

A GIS is Already More than a System

What in the world is a "GIS"?

—Item on the Internet's comp.infosystems.gis FAQ.

- ***geographic(al) information system***: (1) A set of computer tools for analyzing spatial data: (2) A special case of an information system designed for spatial data: (3) An approach to the scientific analysis and use of spatial data: (4) A multibillion dollar business.

GIS is an Approach to Science

"*the generic issues that surround the use of GIS technology, impede its successful implementation, or emerge from an understanding of its potential capabilities.*"

(Goodchild, 1992)

☞Geographic Information Science **is research both *on* and *with* GIS**.

The Role of Computing

"Computing is not about computers any more. It is about **living**."

Nicholas Negroponte, Founding Director of MIT's Media Lab. *Being Digital* (1995), p. 6.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Audio ports and one USB on side under antenna
Power connector on side
Speaker
Directional pad
Back-light control
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Capacitive touchpad area
Mouse buttons
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The Apple iPhone 3G with GPS

GIS is an Approach to the World

GIS is not about systems any more.
It is about **geography**.

Greater potential than most other sciences for the tools and the science to go **above and beyond technology**.

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Next Topic:

A Brief Look at Remote Sensing