

GIS Data: Sources and Capture

Data Collection

- Capture: becomes digital
 - primary: “born digital”
 - secondary: digitized
- Transfer: acquired/digitized by someone else
- Either way, you still may have to
 - edit and clean
 - re-project
 - generalize

Data Collection Techniques

- Raster

- primary

- digital remote sensing

- secondary

- scanned photographs
 - scanned maps
 - DEMs from maps

- Vector

- primary

- GPS
 - surveying

- secondary

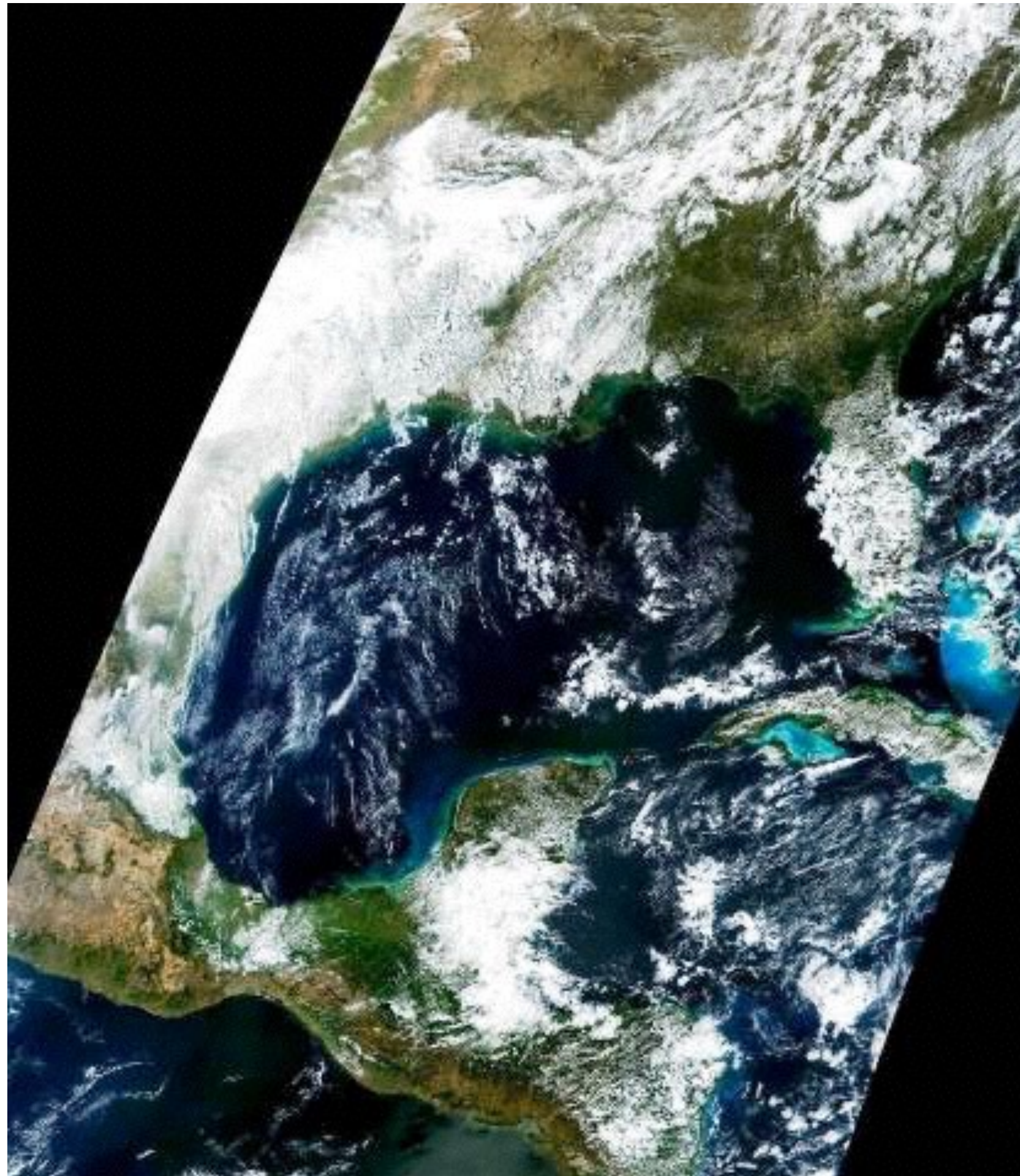
- topographic surveys
 - toponomy from text

Raster Primary Data Capture

- Remote sensing
 - passive
 - optical scanners
 - microwave radiometers
 - active
 - radar
 - lidar
- Resolution
 - spatial
 - cell size
 - swath width
 - spectral
 - bandwidth
 - #bands
 - temporal
 - repeat cycle
 - radiometric
 - range
 - precision

MODIS

(MODerate-resolution Imaging Spectrometer)



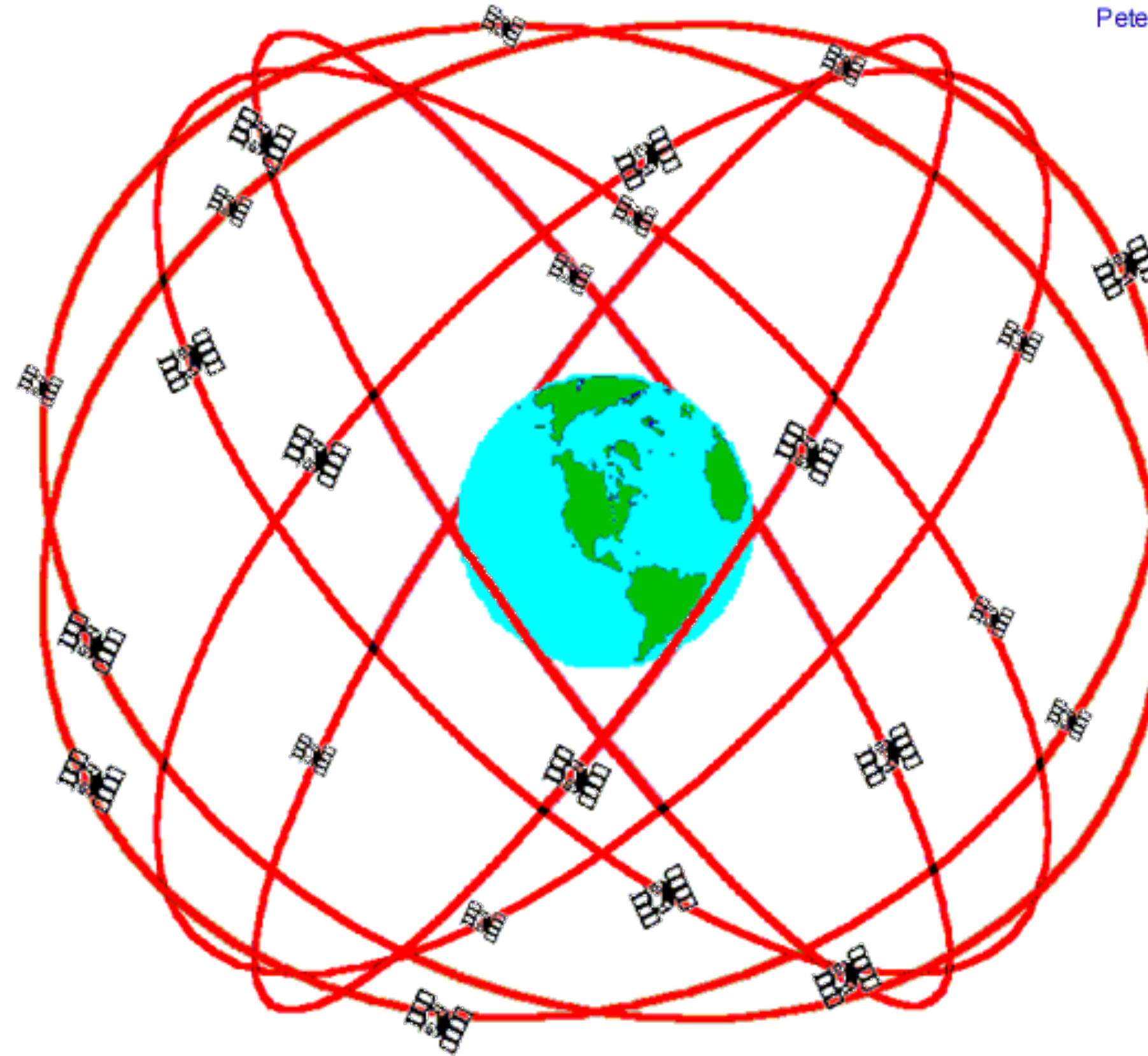
- Platforms
 - EOS Terra (since Feb 2000)
 - EOS Aqua (since May 2002)
- Spatial
 - 2330 km swath
 - 250..1000 m / pixel
- Spectral bands
 - 36 visible, near-IR, thermal
- Temporal
 - every 1..2 days
 - 100% duty cycle
- Data rate
 - 11 Mb/sec \Rightarrow ~22 TB/yr (daylight)

Vector Primary Data Capture

- Surveying
 - Angle and distance measurements from known locations
 - Expensive field equipment and crews
 - Most accurate method for large scale, small areas
- Global Positioning System (GPS)
 - Collection of satellites used to fix location re: Earth center
 - Differential GPS used to improve accuracy

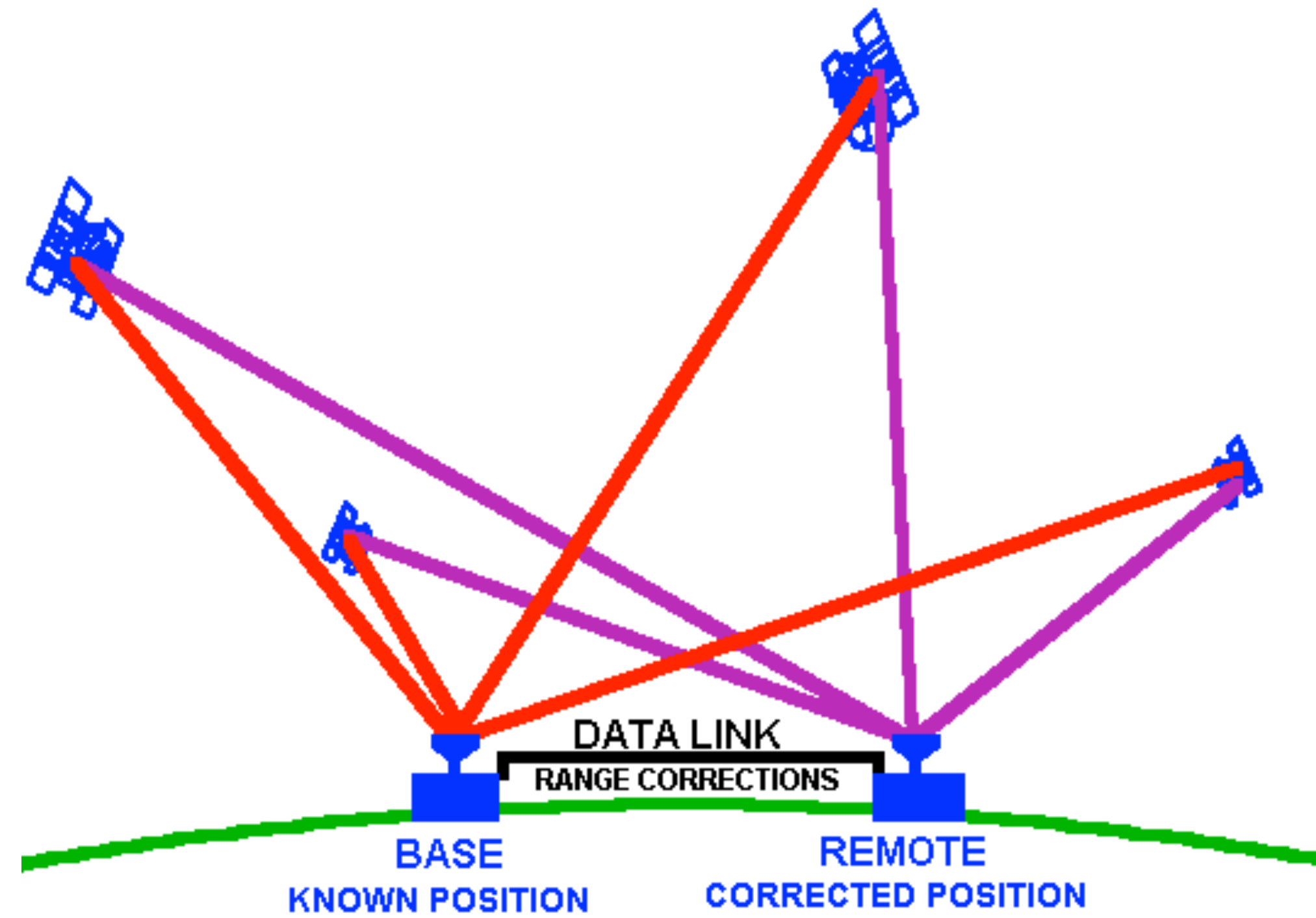
GPS: Satellites

Peter H. Dana 9/22/98



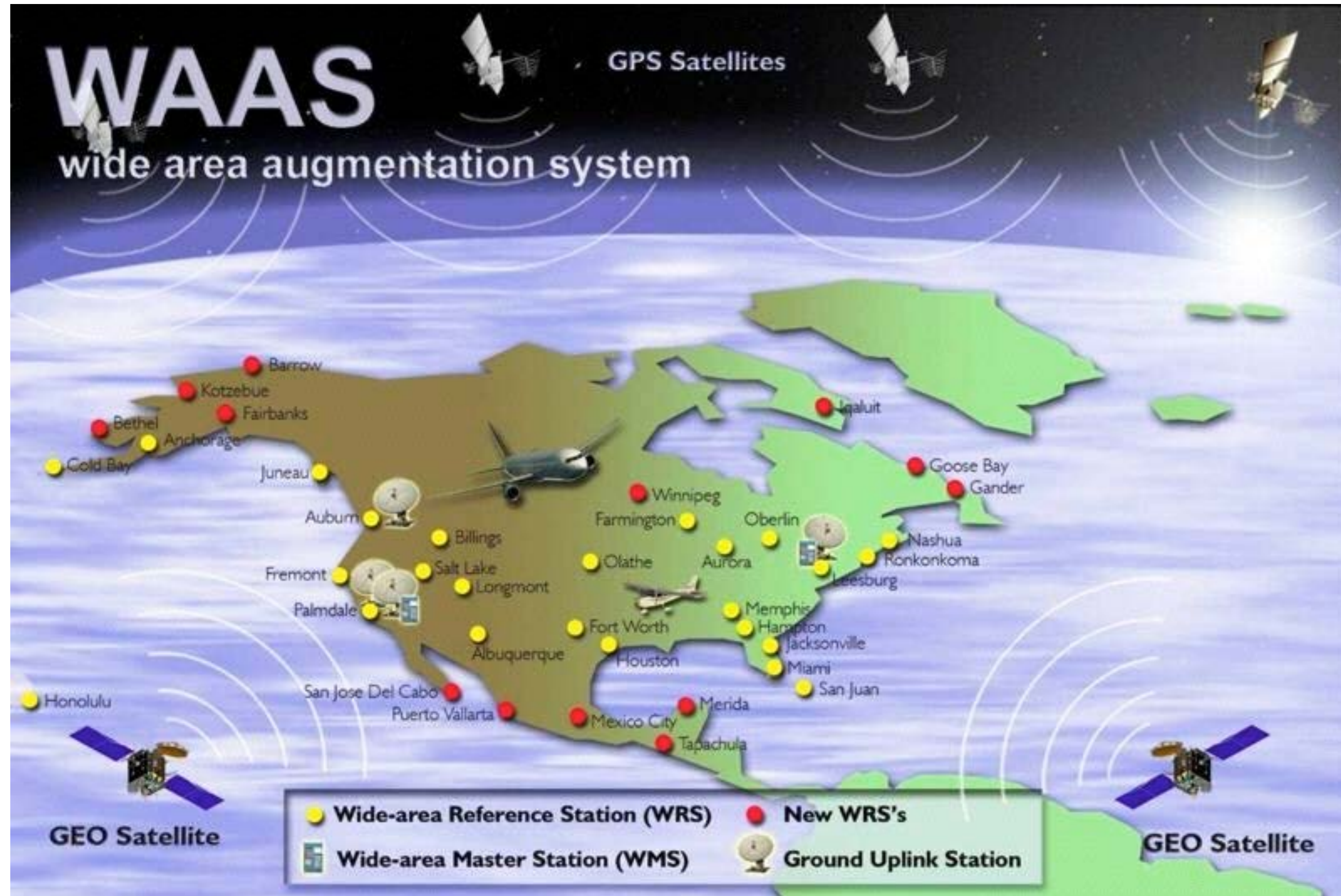
GPS Nominal Constellation
24 Satellites in 6 Orbital Planes
4 Satellites in each Plane
20,200 km Altitudes, 55 Degree Inclination

Differential GPS



PHDANA 10/92

Wide Area Augmentation System

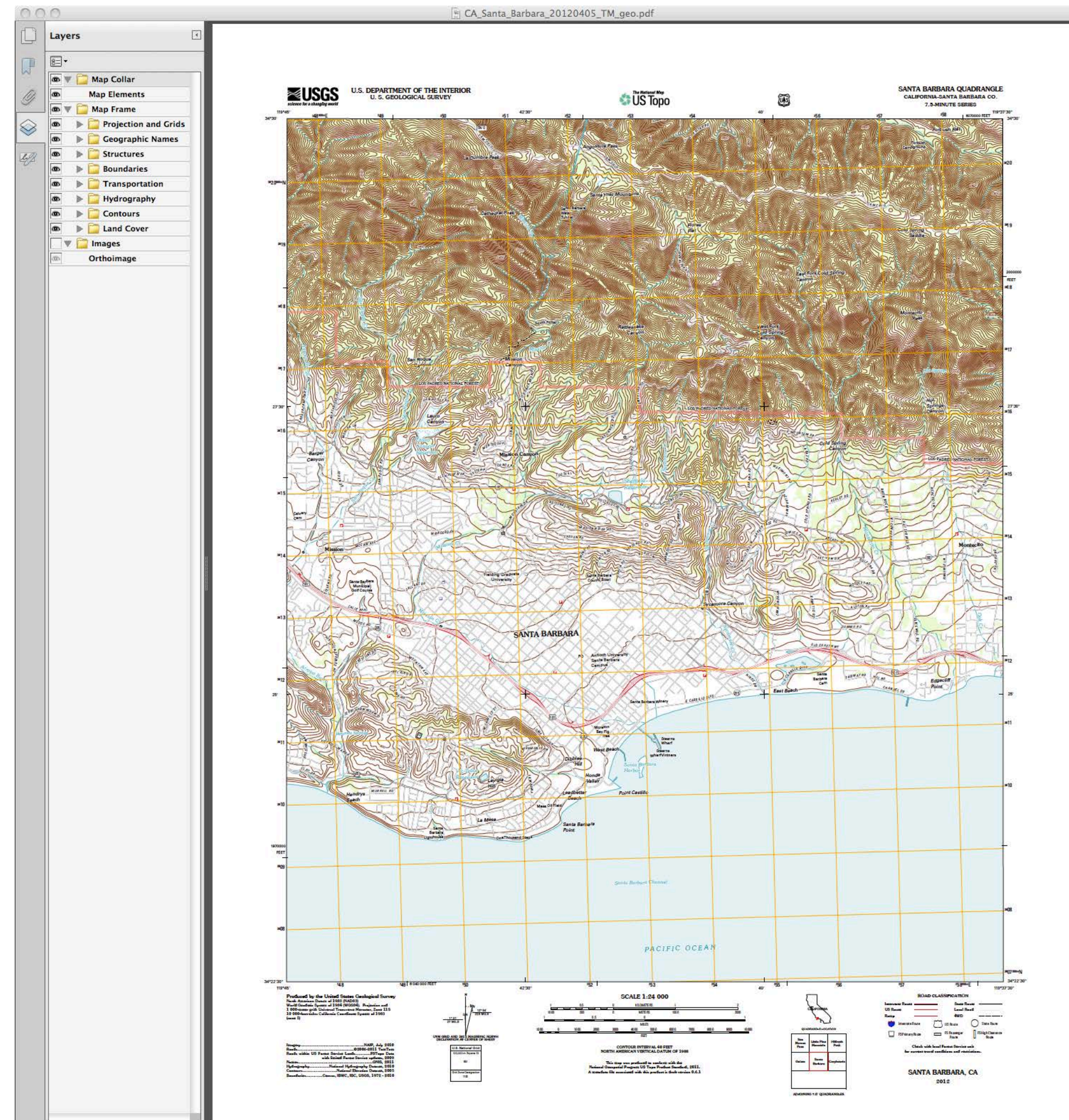


Secondary Data Capture

- Data collected for other purposes can be converted for use in GIS
- Raster conversion
 - Scanning of maps, aerial photographs, documents, etc.
 - Important parameters:
 - spatial resolution (dots per inch)
 - radiometric resolution (bits per pixel)

Scanning Example: US Topo

- USGS topo maps in PDF
 - “GeoPDF” metadata
- New & historical
 - new: multi layers
 - old: single scan
- Mix of projections and scan methods



Scanning Examples: US Topo

- Orientation issues
 - Boundaries
 - meridians and parallels
 - Projection
 - LCC (older)
 - UTM (newer)
 - meridians pinch;
parallels curve
 - Map sheet
 - quad bounding rectangle
 - not projection-aligned

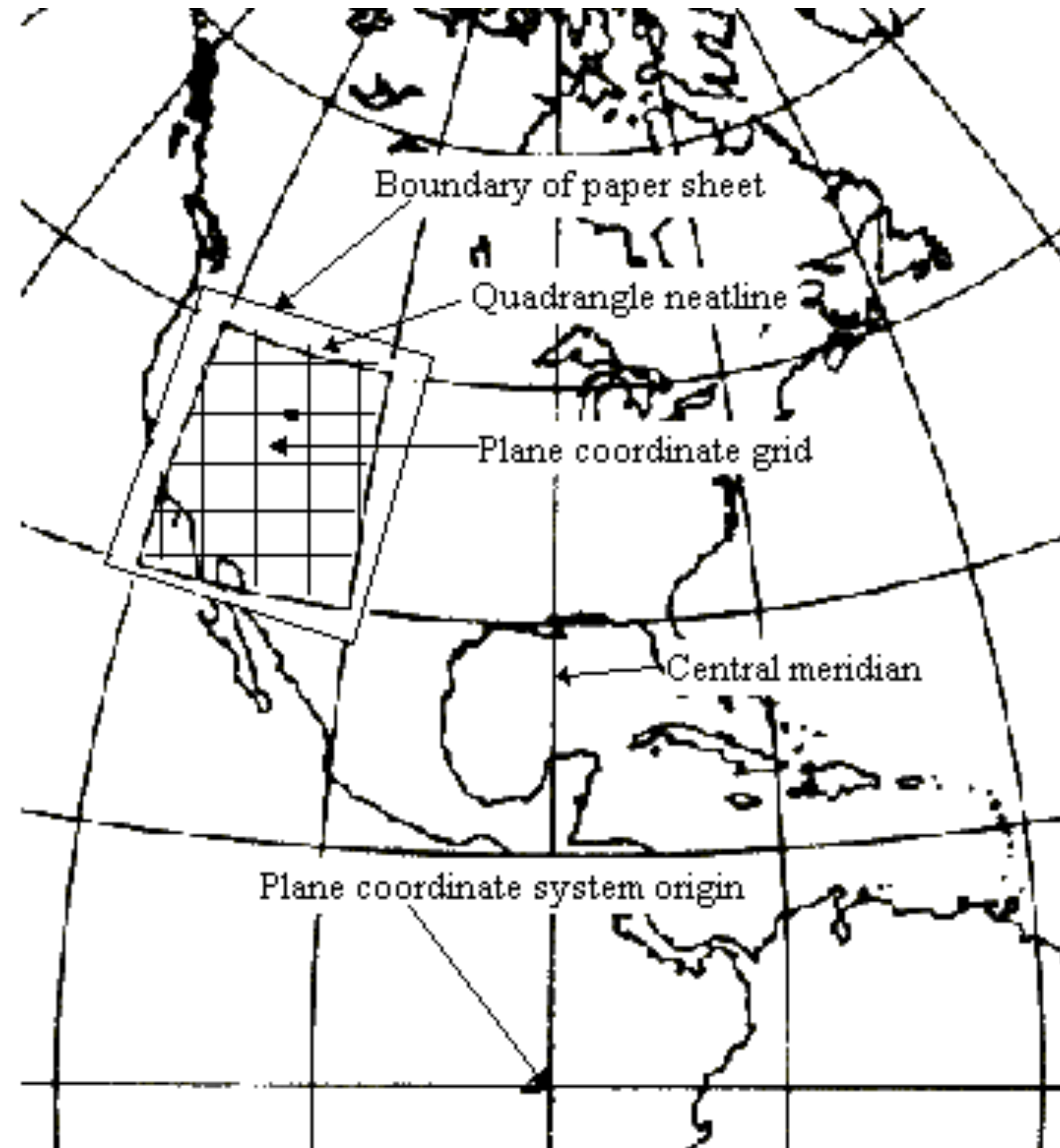


Figure 6. Plane grid, quadrangle neatline, and map sheet relationships.

Vector Secondary Data Capture

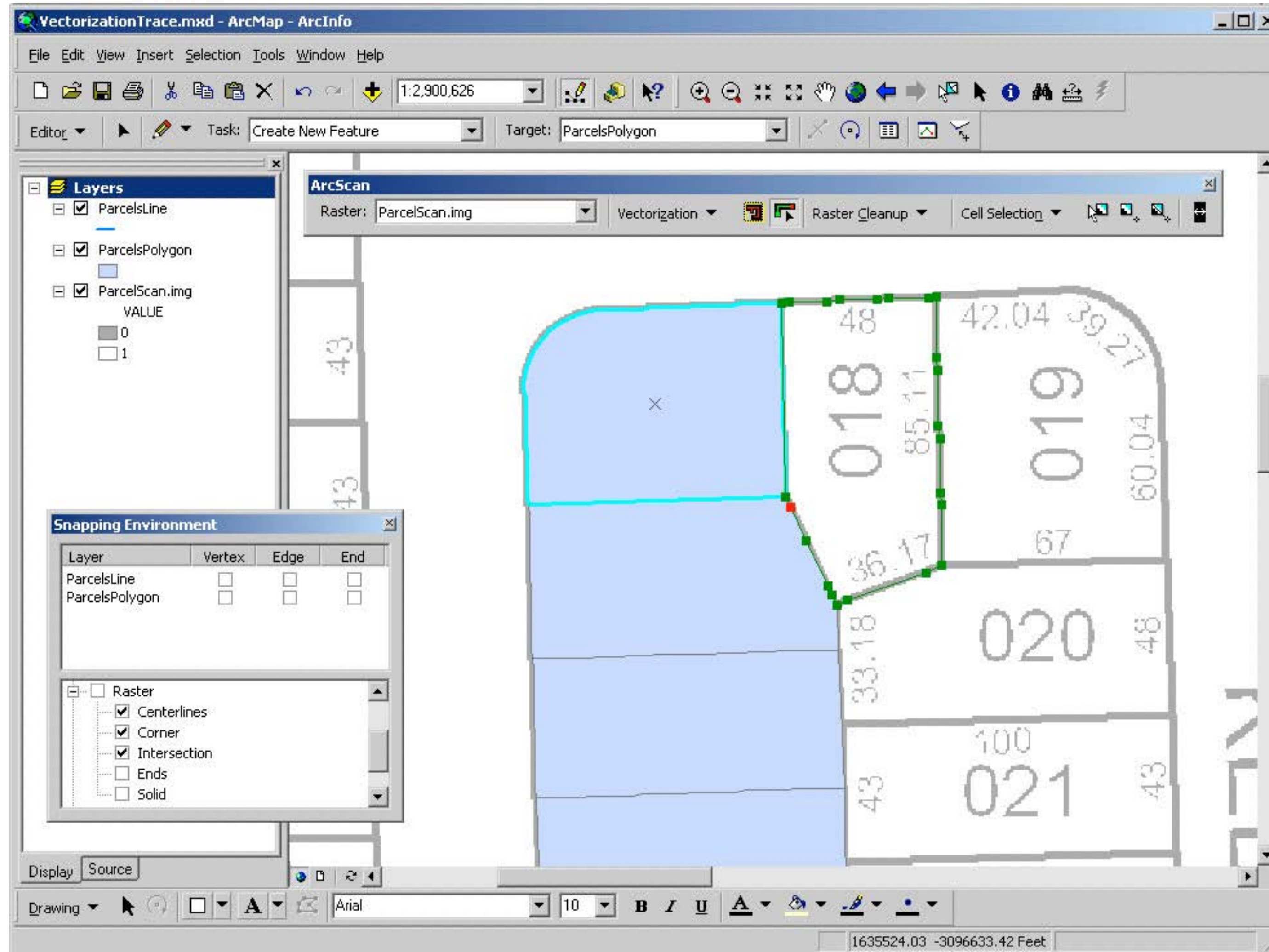
- Manual
 - Keyboard
 - transcription
 - "heads-up" digitizing
 - (see Law ch. 12)
 - Coordinate digitizer
 - Point
 - Stream
- Automatic
 - Scan
 - `vector = line_detect(raster)`
 - OCR

Digitizing Tolerance

- Lines closer than snapping tolerance are “snapped” together



Raster → Vector: ArcScan



Vectorization Artifacts

- raster line in scanned file has width of several pixels.
- ↑ raster line width when lines meet or intersect.

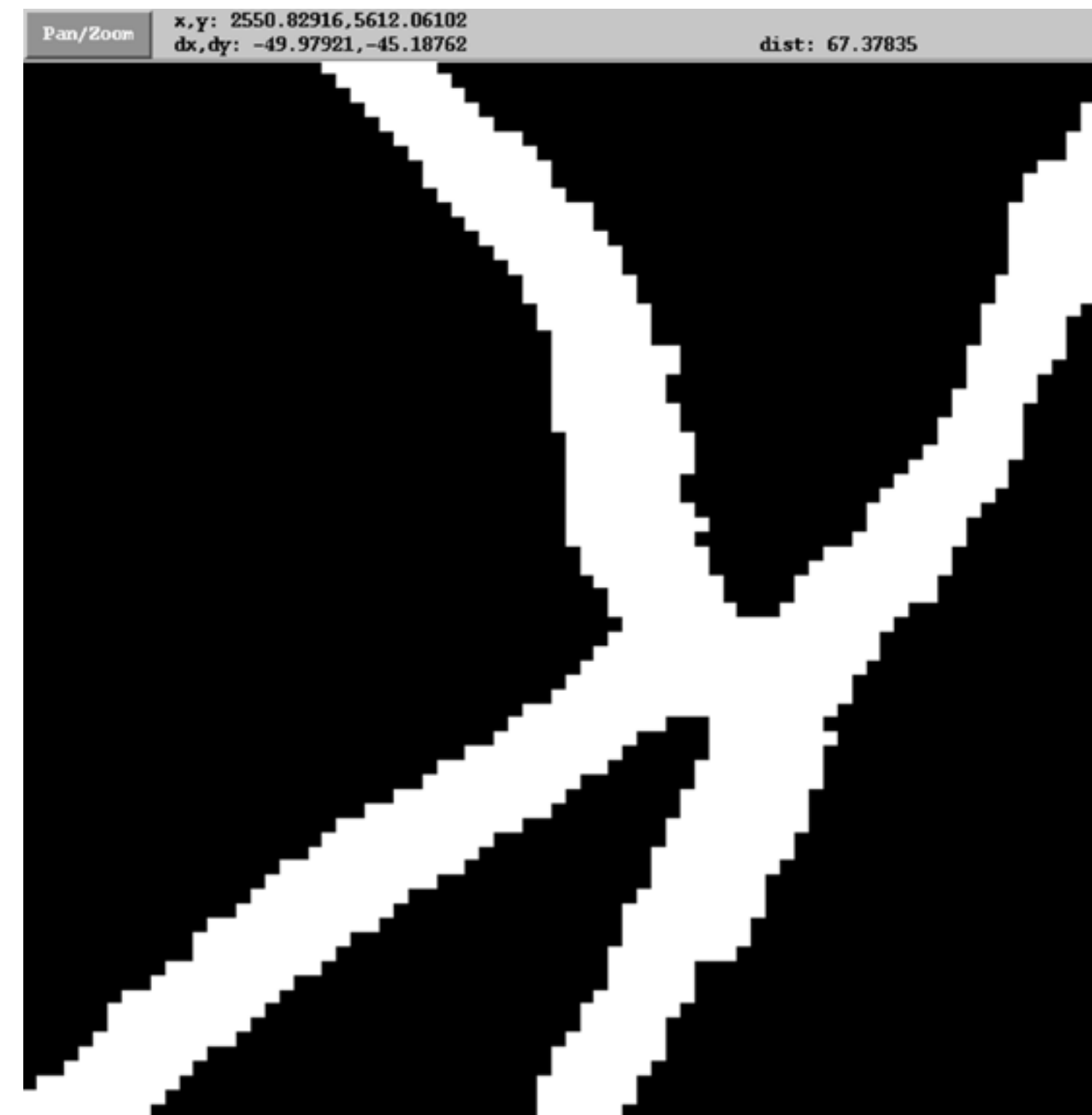
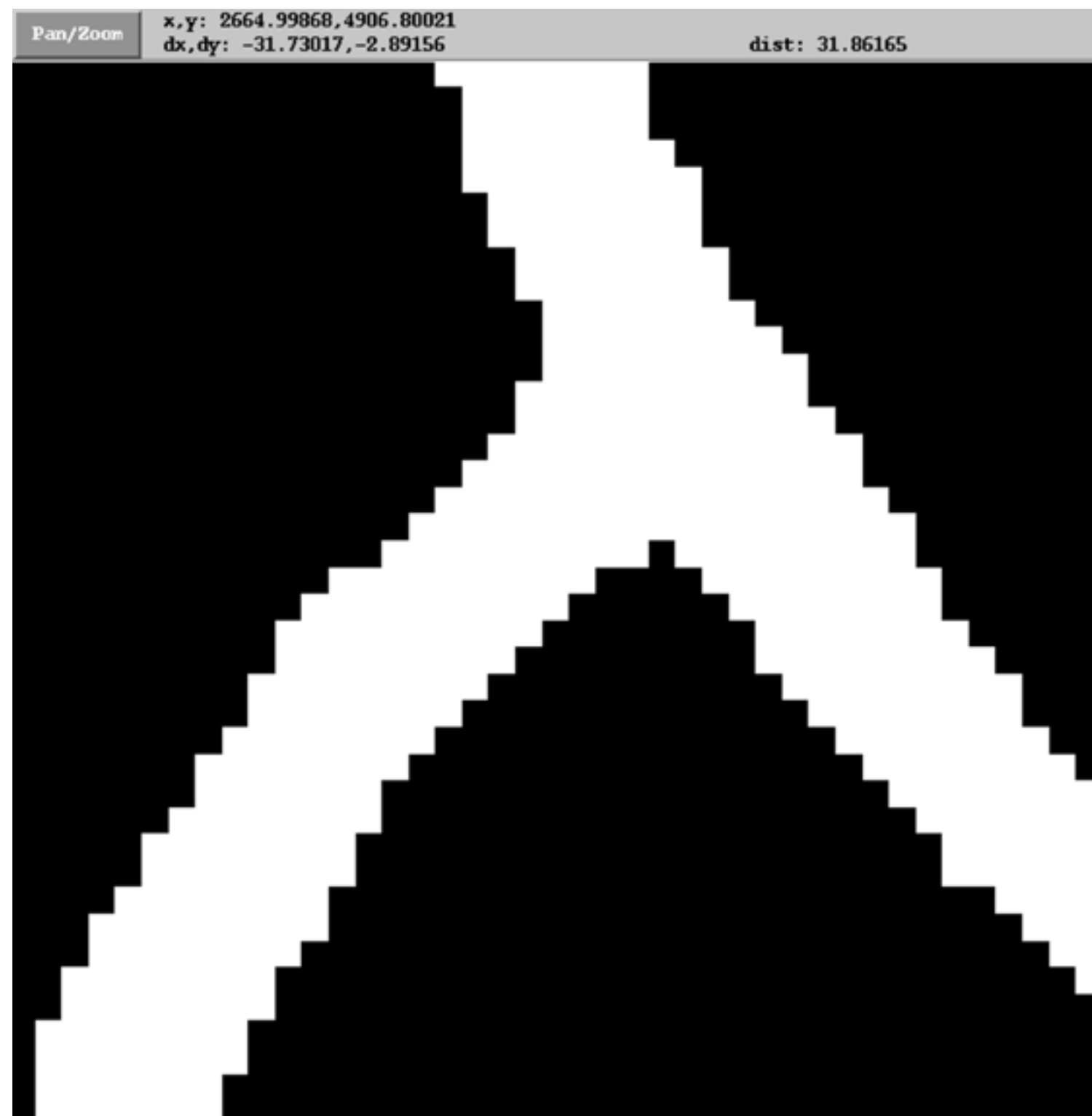


Figure Credits

- ArcMap Help
- Geographic Information Systems and Science, 2nd ed.
– ISBN 978-0470870013
- Global Positioning System Overview
- Introduction to Geographic Information Systems, 4th ed.
– ISBN 978-0-07-305115-2
- Using ArcGIS Spatial Analyst