Spatially Enabled E-Government

Michael F. Goodchild
University of California
Santa Barbara

GIS and E-Government

- GIServices provided remotely
  - finding locations
  - providing directions
  - providing maps
  - evacuation routes
  - plume dispersal models
- Sharing government assets
  - data assets
  - warehouses, metadata, catalogs
  - sharing methods and models

Technological drivers

- Connectivity, the Internet
- Home computing
  - thin clients
- Mobile devices
  - locationally enabled
  - in vehicles

YOUR PHONE KNOWS WHERE YOU ARE

Illustration by Tavis Coburn

With E911, your cellphone's location can be tracked within seconds. Sounds great for emergencies, but is there a dark side?

1 | 2

In February 2001, while driving on the state turnpike to her home in Miramar, Florida, 32-year-old Karla Gutierrez lost control of her BMW 328i and skidded into a canal. She dialed 911 on a cellphone and explained her predicament as the vehicle slowly sank. But since Gutierrez couldn't describe her precise location—"I'm not sure where I am," she told the operator—Miami-Dade County rescue units didn't know where to go to save her. By the time a passing patrolman noticed a busted fence by the accident site and found Gutierrez, she was dead.

Cases like this give emergency workers the shivers. If Gutierrez had called 911 from her home, the dispatcher would have instantly seen her exact location on a computer terminal, because landlines are matched to household addresses in emergency-services databases. But mobile phones are untethered to any network and provide no clue about where an SOS is coming from.

With more than 200,000 emergency calls coming from cellphones daily, the Federal Communications Commission is eager to remedy this defect. In 1997, the agency ordered wireless carriers to equip their systems with Enhanced 911 (E911) technologies, which would enable rescuers to pinpoint a caller's location to within a few dozen meters. But privacy advocates aren't convinced that the upgrade, due to be

related links

All Eyes Are On You: Who's tracking the digital DNA you scatter?

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Rental-car firm exceeding the privacy limit?

By Robert Lemos
Staff Writer
June 20, 2001, 11:35 AM PT

Car renters beware: Big Brother may be riding shotgun.

In a case that could help set the bar for the amount of privacy drivers of rental cars can expect, a Connecticut man is suing a local rental company, Acme Rent-a-Car, after it used GPS (Global Positioning System) technology to track him and then fined him $450 for speeding three times.

The case underscores the ways that new technologies can invade people's privacy, said Richard Smith, chief technologist at the not-for-profit Privacy Foundation.

"Soon our cell phones will be tracking us," he said. "GPS could be one more on the checklist here. Frankly, giving out speeding tickets is the job of the police, not of private industry."

Rental car companies have used GPS devices since the mid-1990s, installing systems to give drivers directions while they're on the road. "Fleet management" companies such as AirIQ and Fleetrack are also selling newer tracking services that help companies monitor their vehicles.

The New Haven Small Claims Court case pits New Haven

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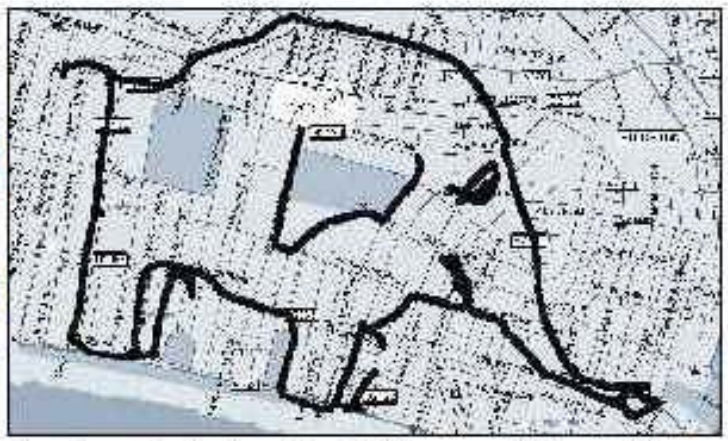
Safari by satellite



The biggest elephant in Brighton - and the world

Satellite tracking is commonly used to avoid traffic jams. But it is now being used to find elephants in Brighton, writes BBC News Online's technology correspondent Mark Ward

The evidence of our effect on the land is all around us.

Roads divide landscapes, hills are shorn of their trees, tunnels are punched through mountains and cities pockmark the countryside with pavements and homes.

dot.life

Every Monday, the guide to getting buttoned up

- Phones, tones and music
- Write here, right now
- Fax machine rebellion
- Ads we can't avoid
- What if ET called us?
- Forgetful? Don't stress

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- 05 Mar 01 | dot life
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- 02 May 00 | Sci/Tech
  Satellite navigation accuracy boosted
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  Satellites in the driving seat

The Death of Distance

- Cairncross 1997
- Cost(distance) = 0
  - every point is as accessible as every other point
  - "there is no more there, everywhere is here" (Anna Paquin)
  - social networks are independent of distance
    - *p*(receiving email from any point on Earth) = constant
  - location on the Web is transparent
  - returns to Web searches are independent of location
    - *p*(hit anywhere on Earth) = constant

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THE INTERNET

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The revenge of geography

Mar 13th 2003
From The Economist print edition

It was naive to imagine that the global reach of the internet would make geography irrelevant. Wireline and wireless technologies have bound the virtual and physical worlds closer than ever

IN THE early days of the internet boom, there was much talk of the "death of distance". The emergence of a global digital network, it seemed, would put an end to mundane physical or geographical constraints. There was some truth in this. E-mail made it cheap and easy to stay in constant touch with people, whether they lived around the corner or on the other side of the globe. Companies could communicate with customers and employees no matter where they were. And like-minded individuals who shared a common interest could get together online from all round the world.

Actually, geography is far from dead. Although it is often helpful to think of the internet as a parallel digital universe, or an omnipresent "cloud", its users live in the real world where limitations of geography still apply. And these limitations extend online. Finding information relevant to a particular place, or the location associated with a specific piece of information, is not always easy. This has caused a surge of innovation, as new technologies have developed to link places on the internet with places in the real world—stitching together the supposedly separate virtual and physical worlds

The Revenge of Geography

- *Economist* 3/15/03
  - the virtual and physical worlds are increasingly correlated
- Physical distance important in the virtual world
- Physical location allows integration

The locations of e-government

- **u**, the location of the user
  - the user interface location
  - point-like
- **s**, the location of interest
  - a region
  - often centered on **u**
- **d**, the location of data storage
- **p**, the location of processing

Services for the user

- Maps, data based on **s**
  - define **s**
    - may be centered on **u**
  - identify a source of maps and data
    - determining **d**
  - invoke tools for data integration
- Processing services
  - directories, infrastructure for sharing
  - local or remote processing

Defining **s**

- Equal to **u** plus a neighborhood
  - determining **u**
- From a placename
  - invoking a gazetteer service
    - e.g. www.alexandria.ucsb.edu

Determining **u**

- Most computers do not know where they are
  - time zone defines a range of longitude
- Direct measurement
  - GPS
  - cellphone location measurement
  - WiFi, Bluetooth, …
- Input by user or system builder
  - coordinates
  - placename plus gazetteer
  - geocoding
    - geocoding service

Inference about IP

- IP registration record
- Mining text for addresses
- Commercial incentive
  - targeted advertising, spam
  - biased search engines
- Military/intelligence incentive
  - email to a polygon
  - sourcing intelligence

The business of geolocation

- Quova: http://www.quova.com/services/services.html
- Digital Envoy: http://www.digitalenvoy.net/
- NetGeo: http://www.caida.org/tools/utilities/netgeo/
- InfoSplit: http://www.infosplit.com/

InfoSplit
we know where your customers are
about infosplit
products
press room
career center
contact us
demo
Country:KR
Metro area:SEOUL
Infosplit's objective is to offer an accurate geographic profiling solution.
Our patent-pending technology consists in mapping the Internet as precisely as possible.
By growing our database, we improve the accuracy of our data day after day.
Design by
Legal Disclaimer
music Off

Options for **d**

- Where to store data in the SDI?
  - cost of dissemination goes to zero
  - close to **s**
    - access to ground truth
  - level of interest determined by ||**u**-**s**||
    - information of geographically determined interest
    - geographic information is IGDI
    - but other information is not

Implications for finding data

- Heuristics for the SAP
- Geographic information is most likely to be found on a server located within its footprint
  - convergence of **d** and **s**
  - but at what level in the hierarchy?
    - jurisdiction that most closely matches the footprint
    - max $||J \cap F|| / (||J||\ ||F||)^{1/2}$

Transitioning map libraries

- From central services to unique services
  - from general collections to special collections
  - from UCSB's Map and Imagery Laboratory to the Alexandria Digital Library
- There will always be more than one service
  - no amazon.com of geographic information
    - www.alexandria.ucsb.edu
    - www.geographynetwork.com
    - www.geodata.gov
- Unique services must declare themselves
  - through collection-level metadata (CLM)
  - formalizing and publishing **d**

Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Stop

Bookmarks Location: http://webclient.alexandria.ucsb.edu/ What's Rela

Instant Message Internet Lookup New&Cool Netcaster NCGIA Home Page

EXANDRIA DIGITAL LIBRARY

CDL CALIFORNIA DIGITAL LIBRARY

ADL HOME · CDL HOME · HELP

NCK PLACENAME SEARCH

earch the entire world for...

Find

er "Rome" if you want Rome, Italy.

e information

NERAL SEARCH

Select collection to search

DL Catalog

wse collections

Set geographic region

the map to the right to set the geographic ent of the search, or directly enter bounding rdinates below.

N 34.43

W -118.97 -117.57 E

33.73 S

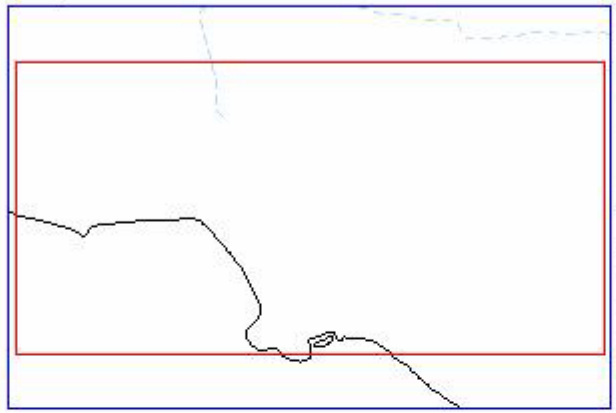
Words to search for

Any of the above words

All of the above words

Exact phrase

Map Browser



Click map to:

Recenter & Zoom in

Change location to:

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Shape

Zoom Out In

Reset

ADL Search Results

The query that produced these results can be found at the bottom of this page.

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2. **DRG o33117g7, Digital Raster Graphic of ORANGE, CA.**
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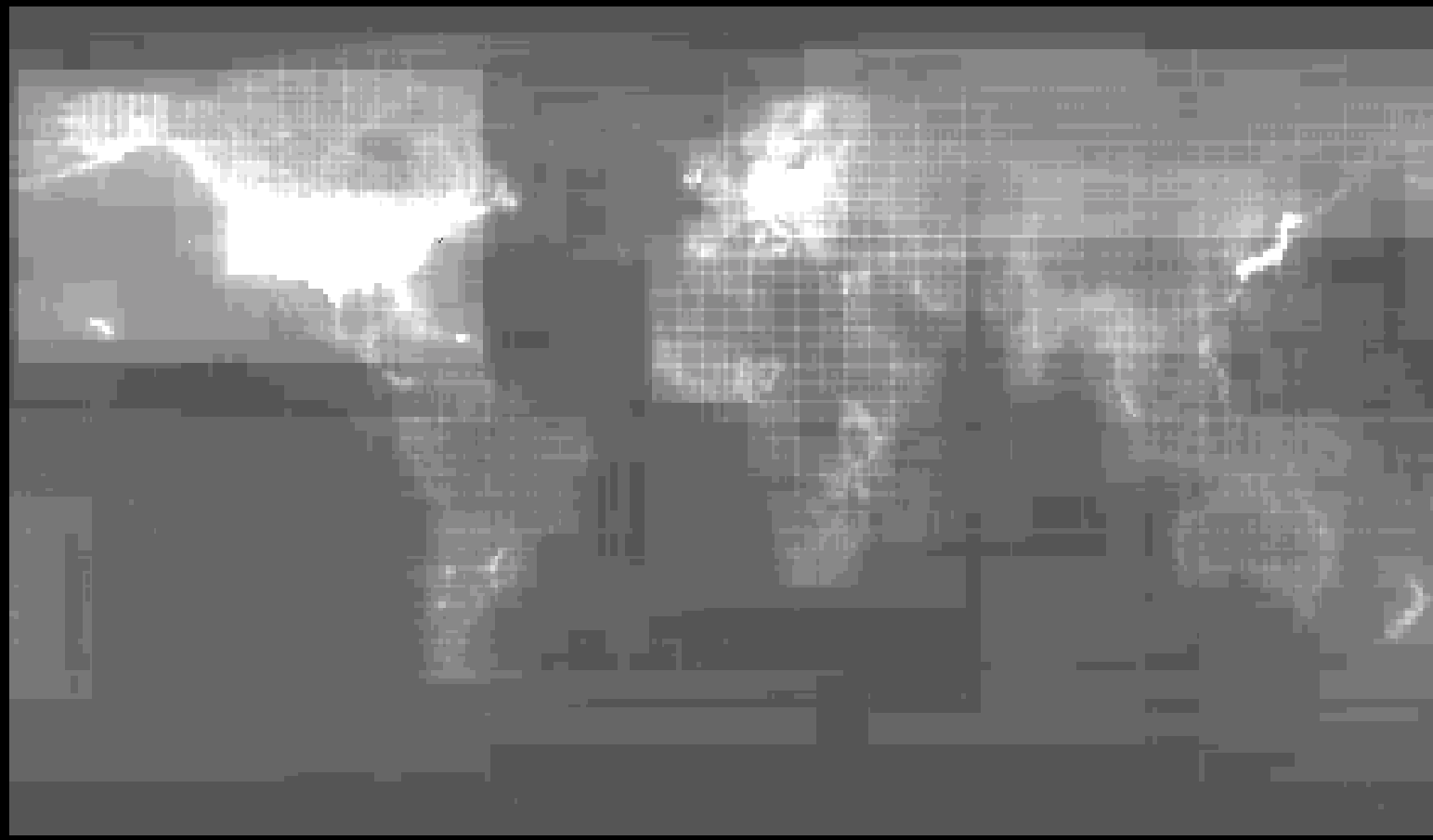
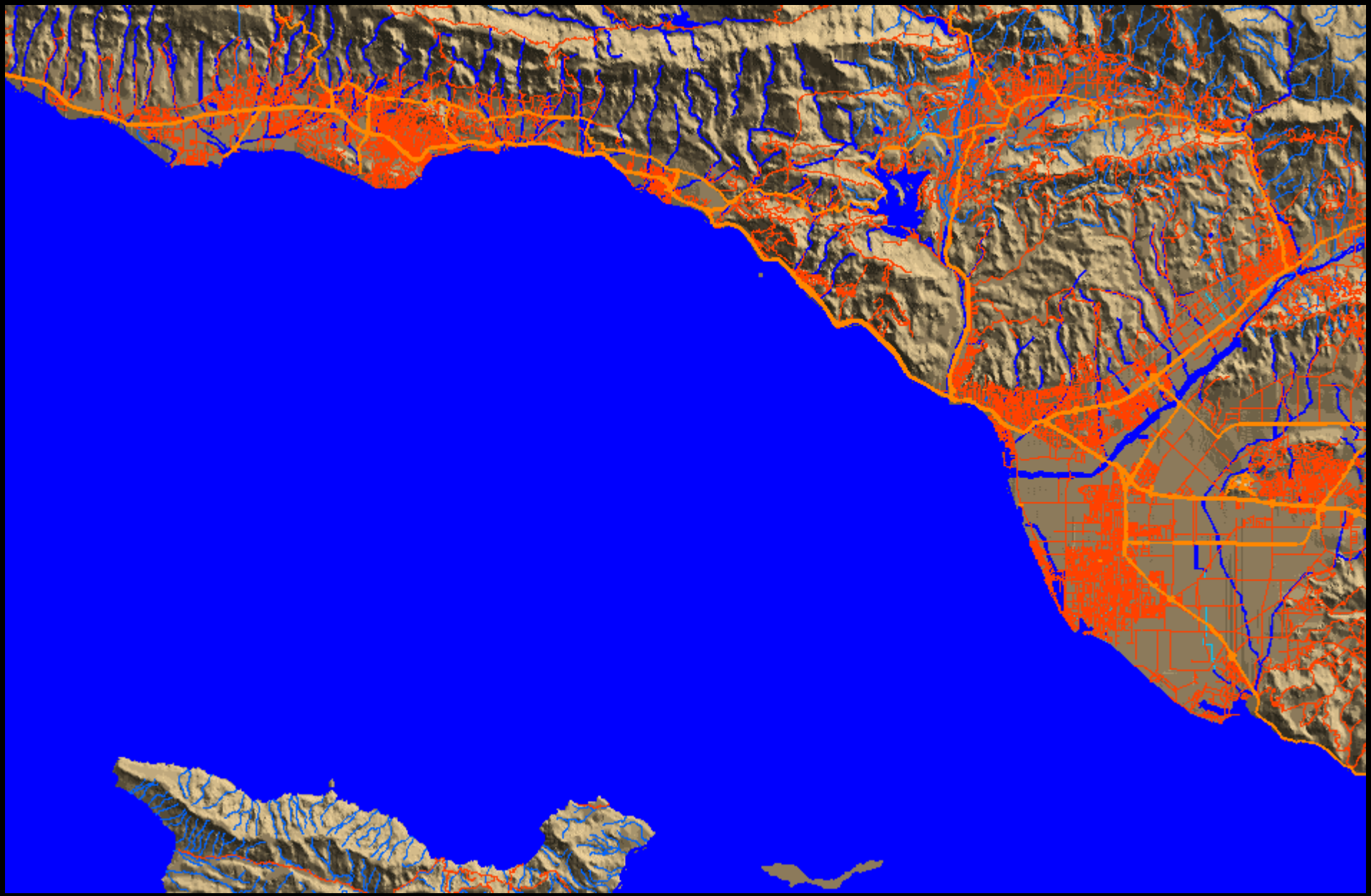
http://big-bertha.alexandria.ucsb.edu:8081/servlet/query?collection=adl_catalog&collection-page=query.html&north=34.43&west=-11

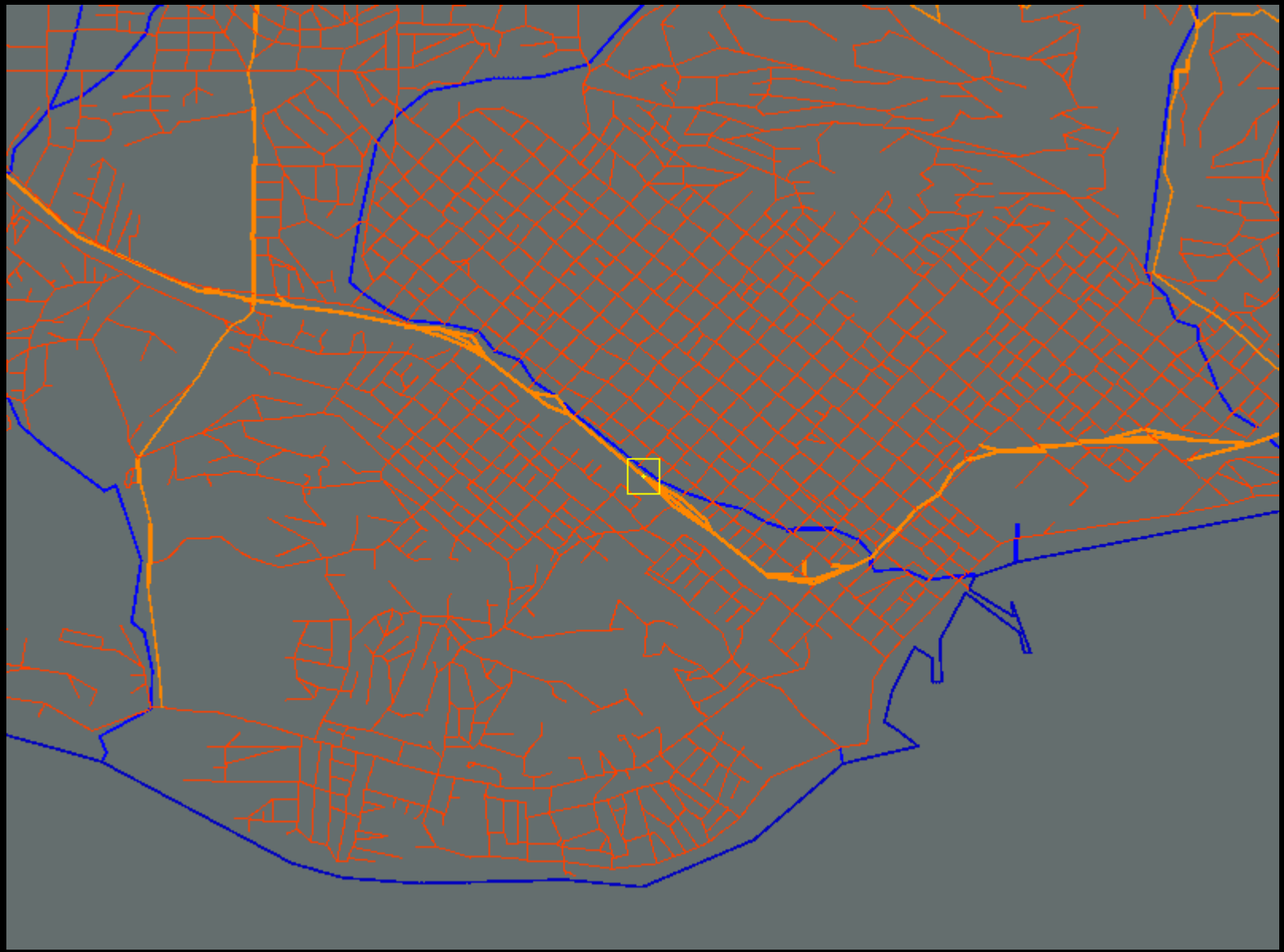


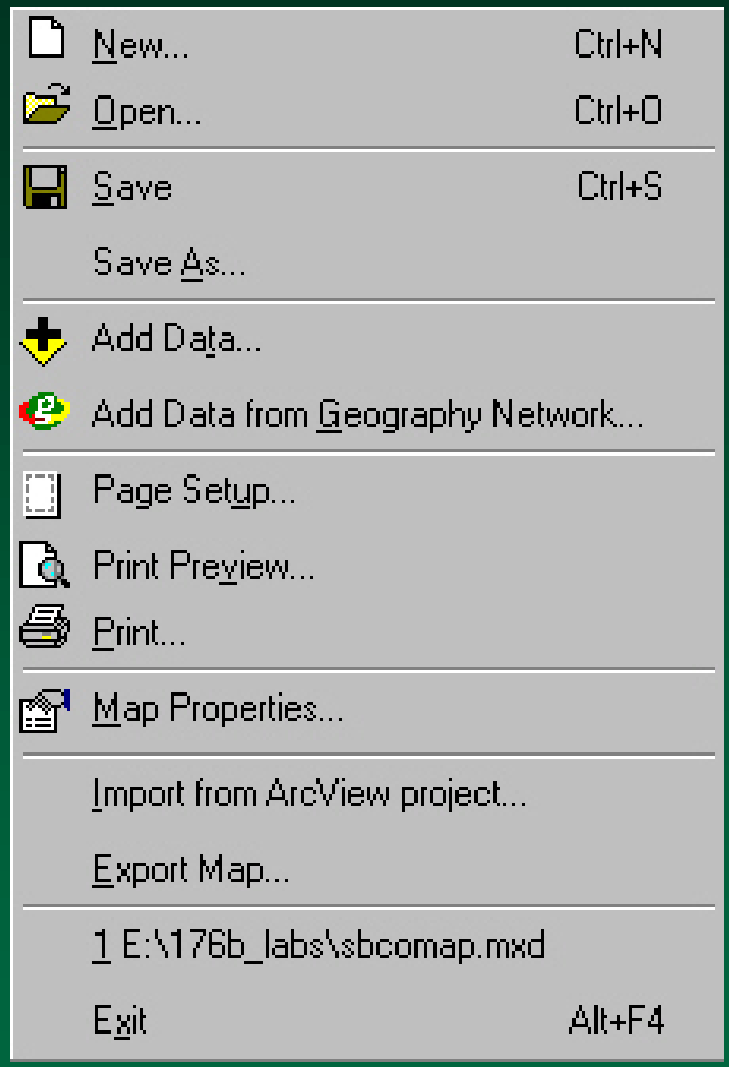
CLM of the Alexandria Digital Library

Knowing where to look

- Approaches to CLM
  - by data type
    - ortho.mit.edu
  - by area of the globe
    - Arctic Data Directory
  - the one stop shop
    - www.geodata.gov
  - a new generation of search engines
    - identifying footprints



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geography network

ACCESS A WORLD OF INFORMATION

ABOUT

MAPS

DATA

GEOSERVICES

SOLUTIONS

COMMUNITY

Geography Network Explorer

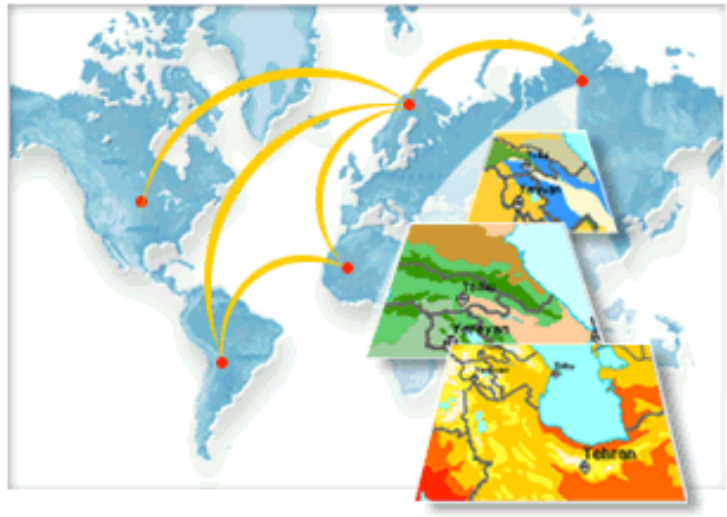
Free Resources

Be a Publisher

SEARCH & VIEW

use the **Geography Network Explorer** to search and view maps and other geographic content over the Internet

The Geography Network is a global community of data providers who are committed to making geographic content available. This content is published from many sites around the world, providing you immediate access to the latest maps, data, and related services. This portal to the Geography Network enables you to discover this content and share your own.



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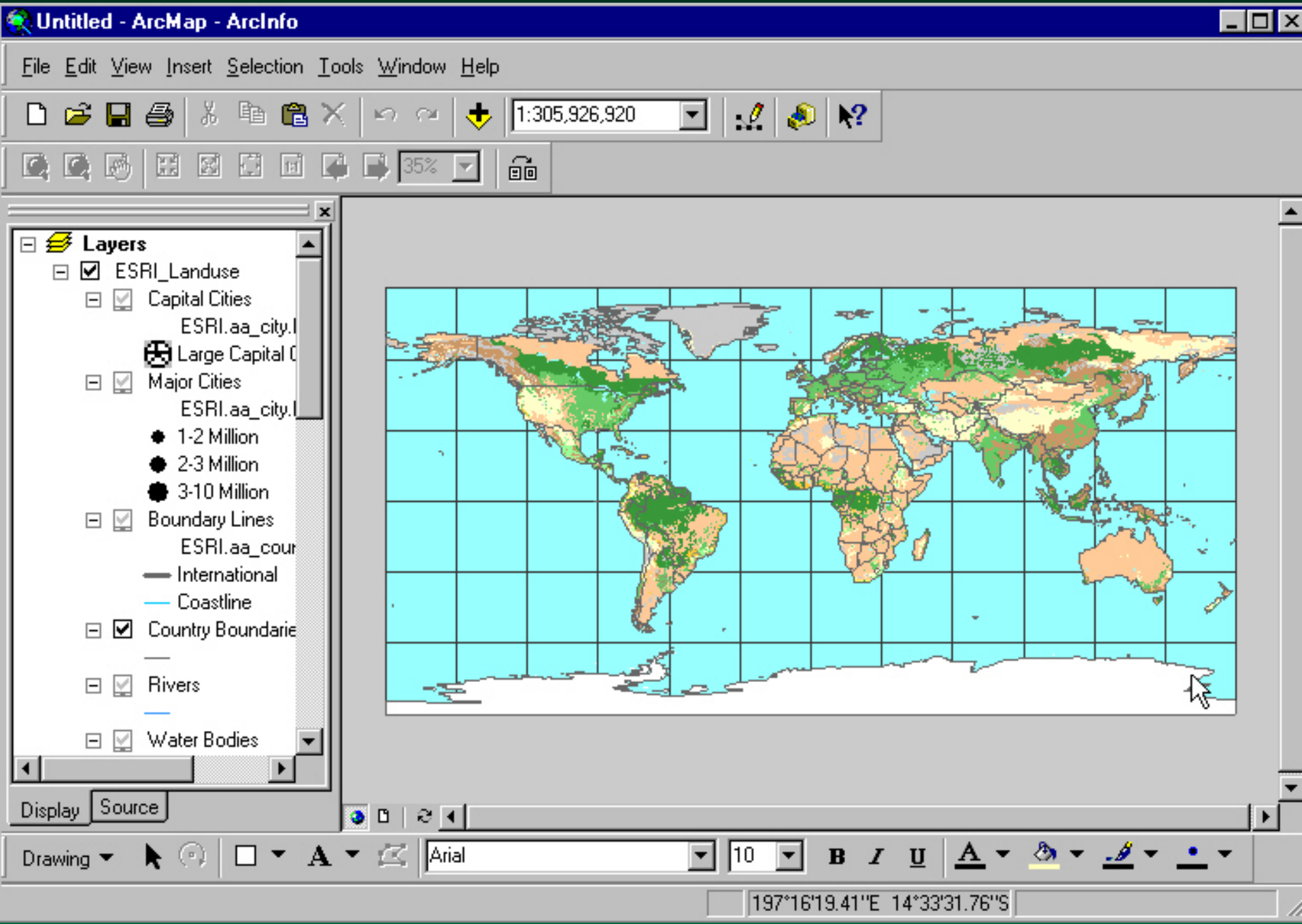
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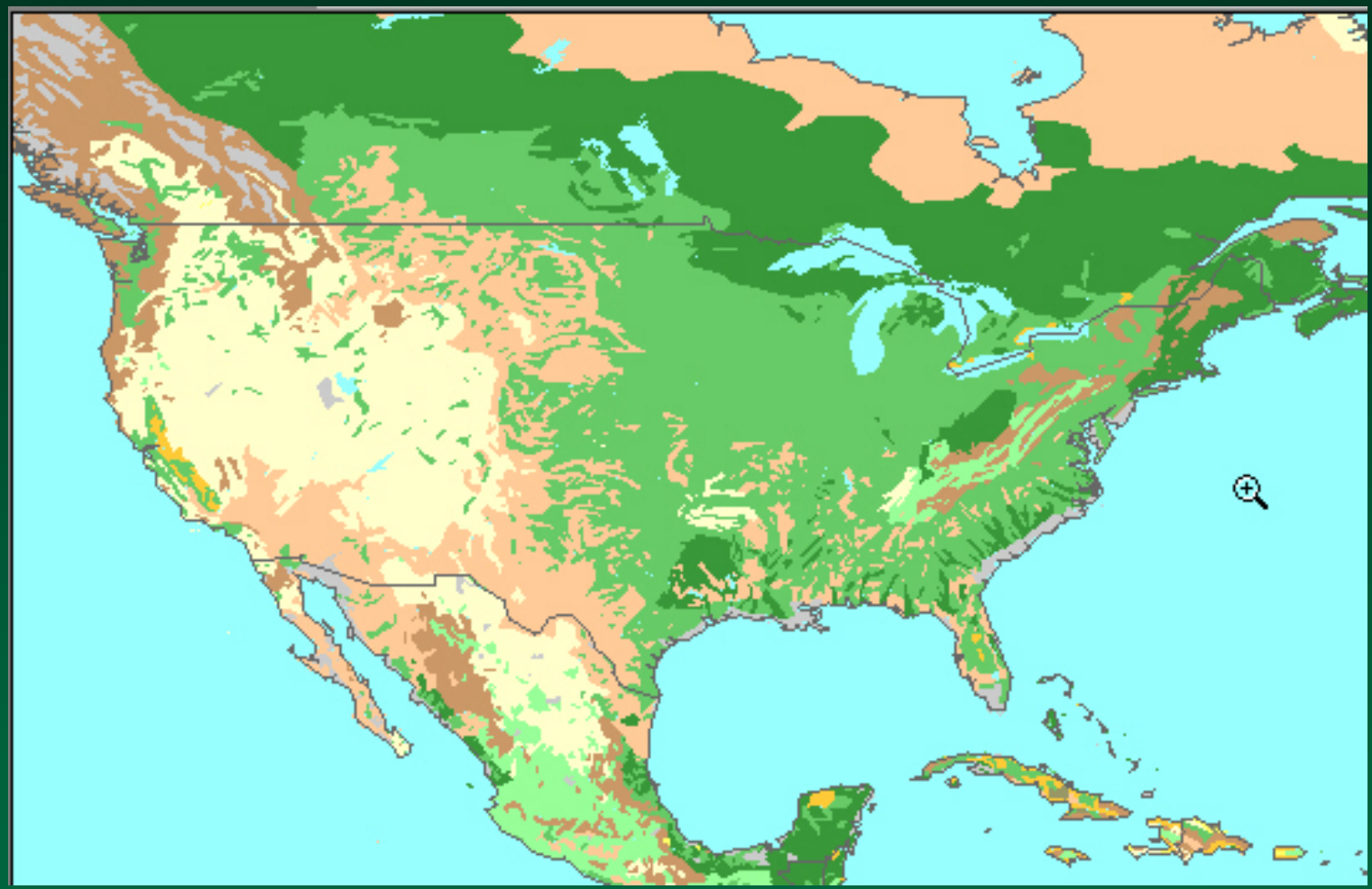

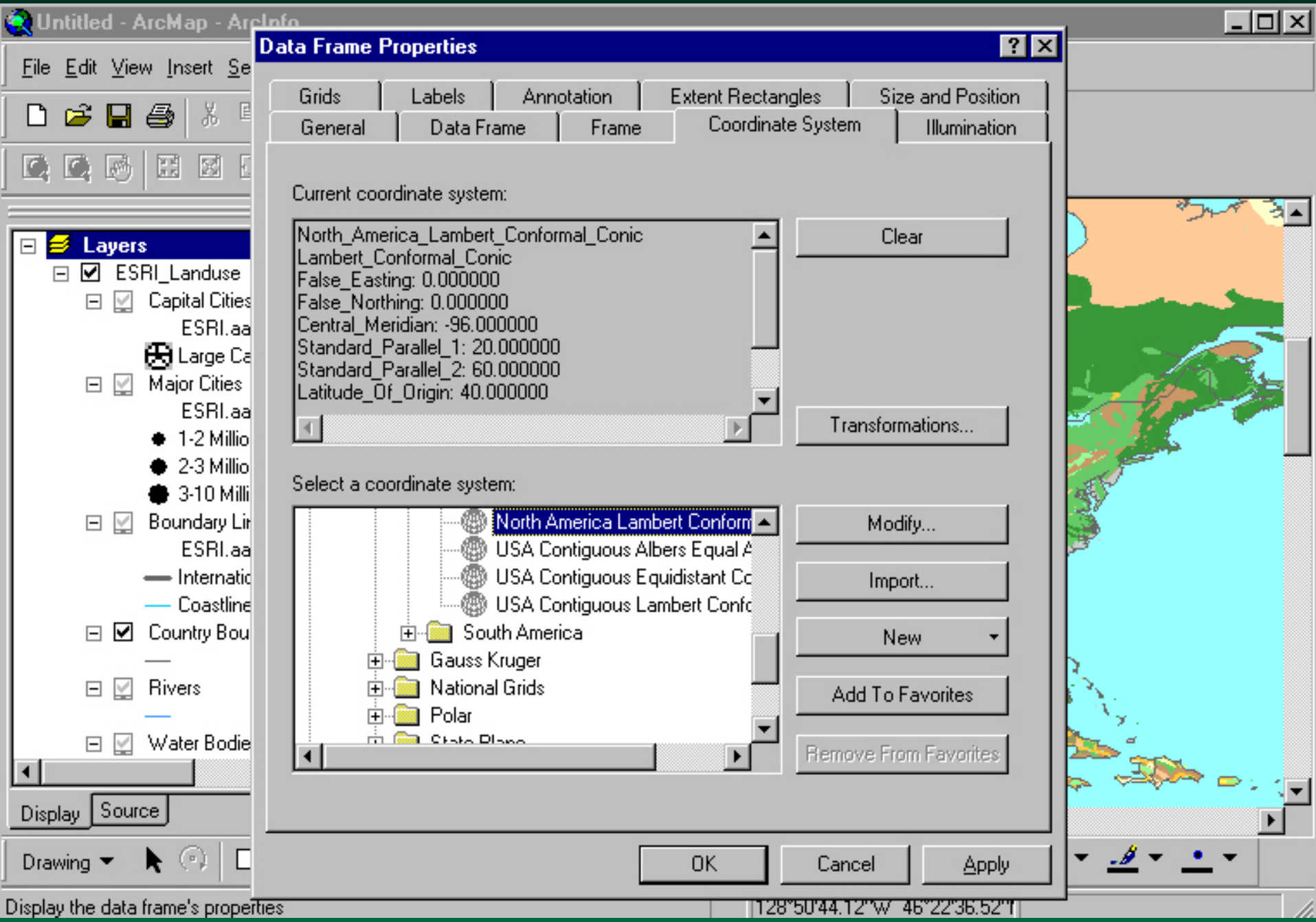
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False_Northing: 0.000000
Central_Meridian: -96.000000
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Standard_Parallel_2: 60.000000
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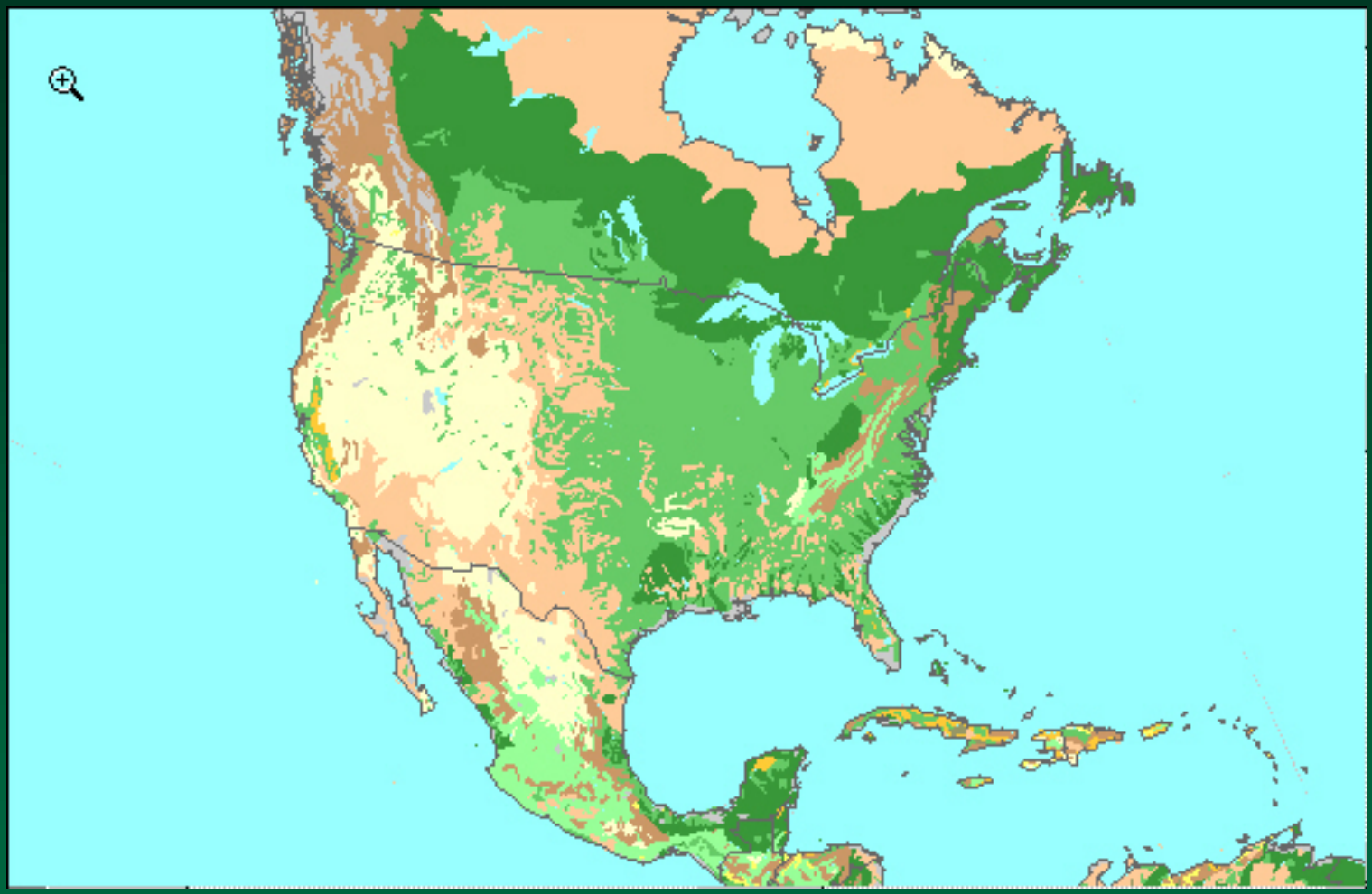

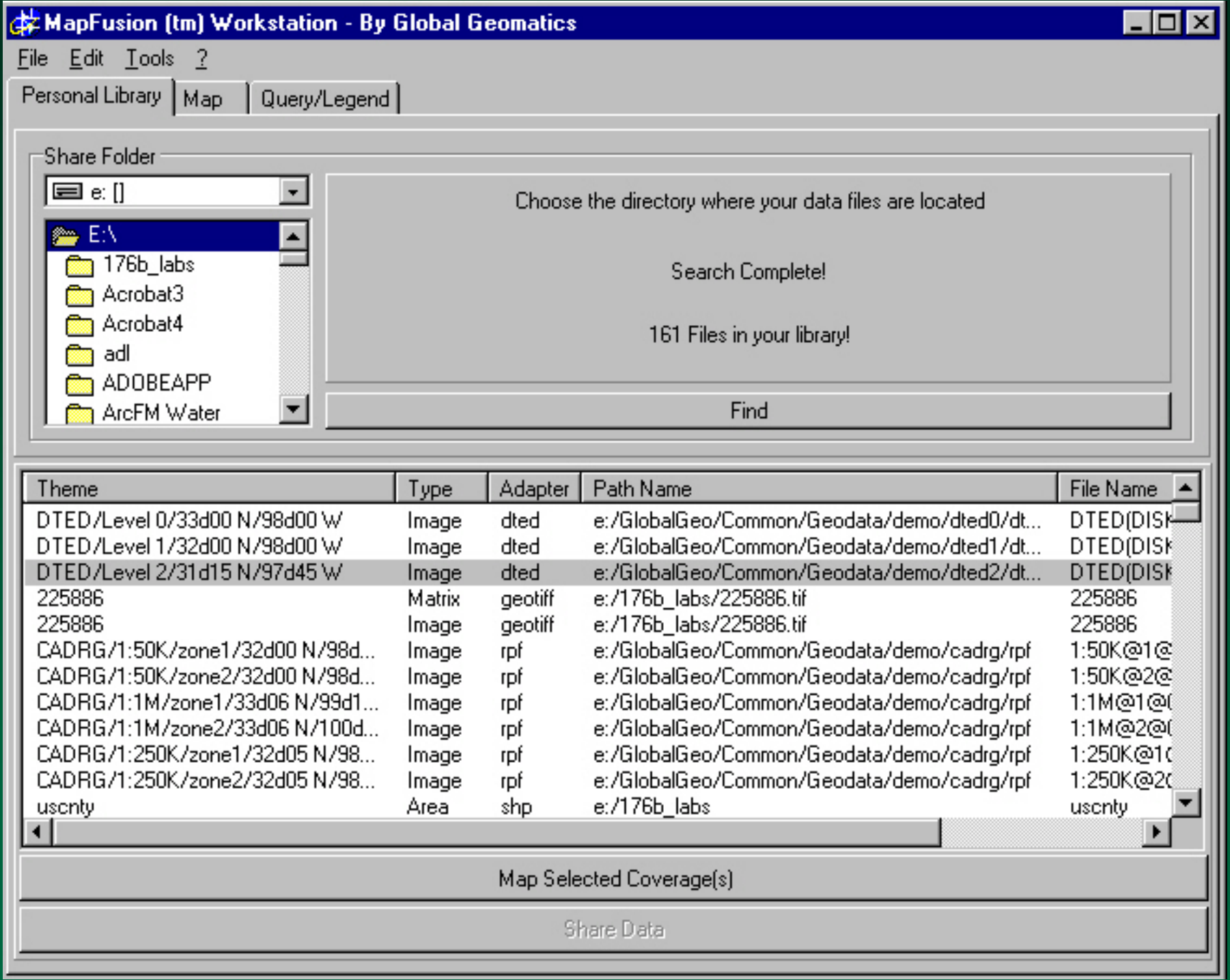
MapFusion (tm) Workstation - By Global Geomatics
File Edit Tools ?
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Query/Legend
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ArcFM Water
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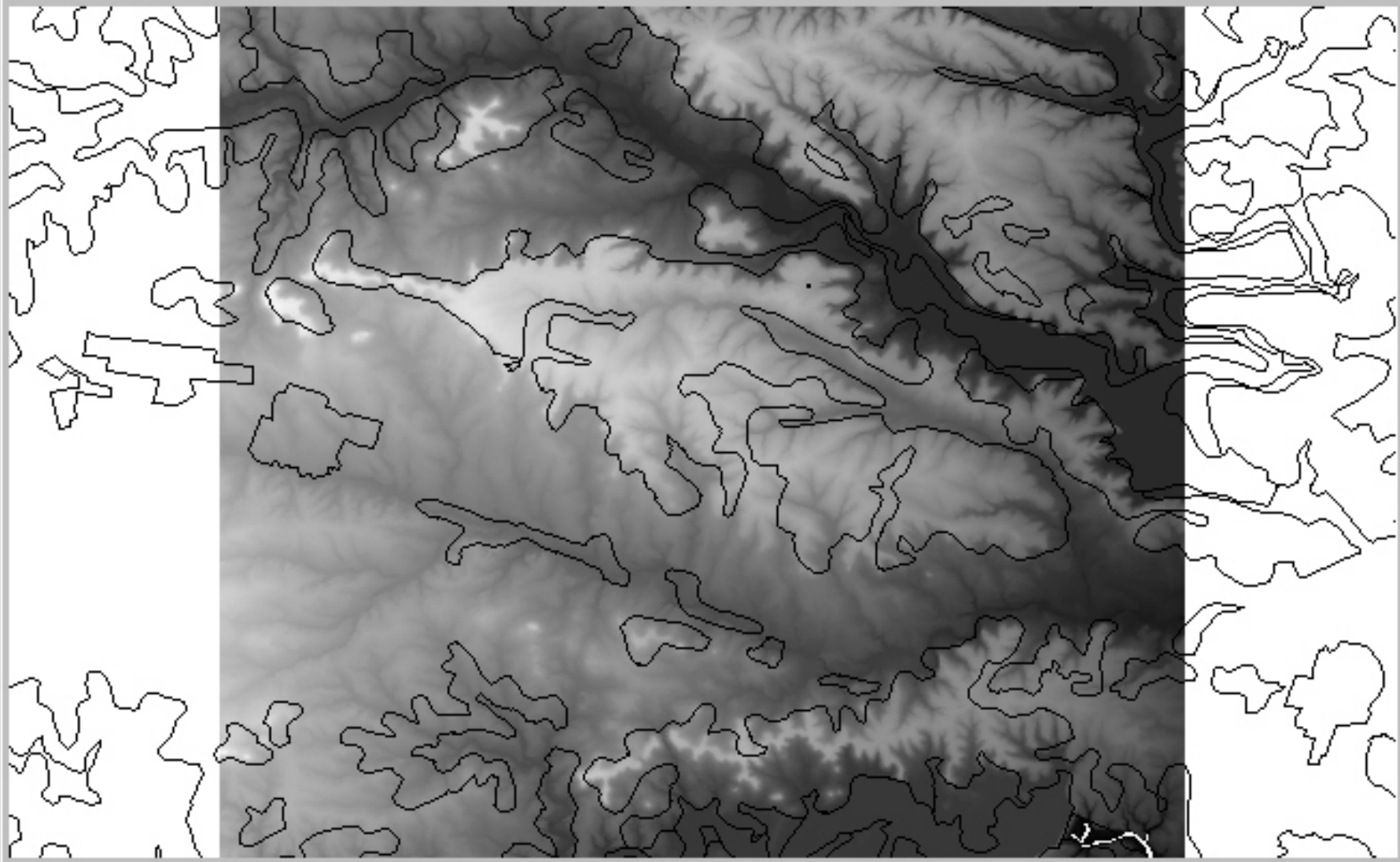
Map Selected Coverage(s)
Share Data

MapFusion (tm) Workstation - By Global Geomatics

File Edit Tools ?

Personal Library | Map | Query/Legend



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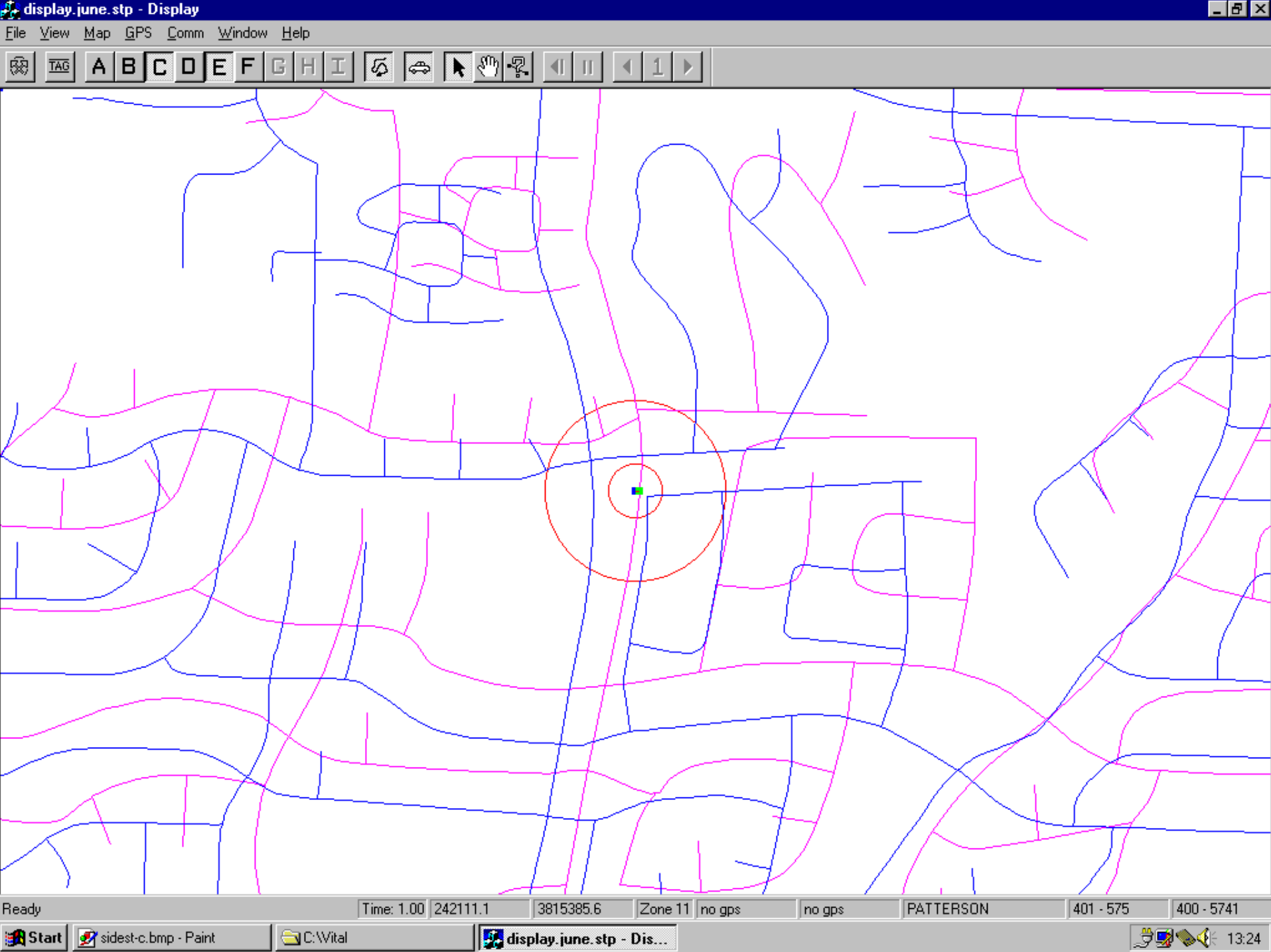
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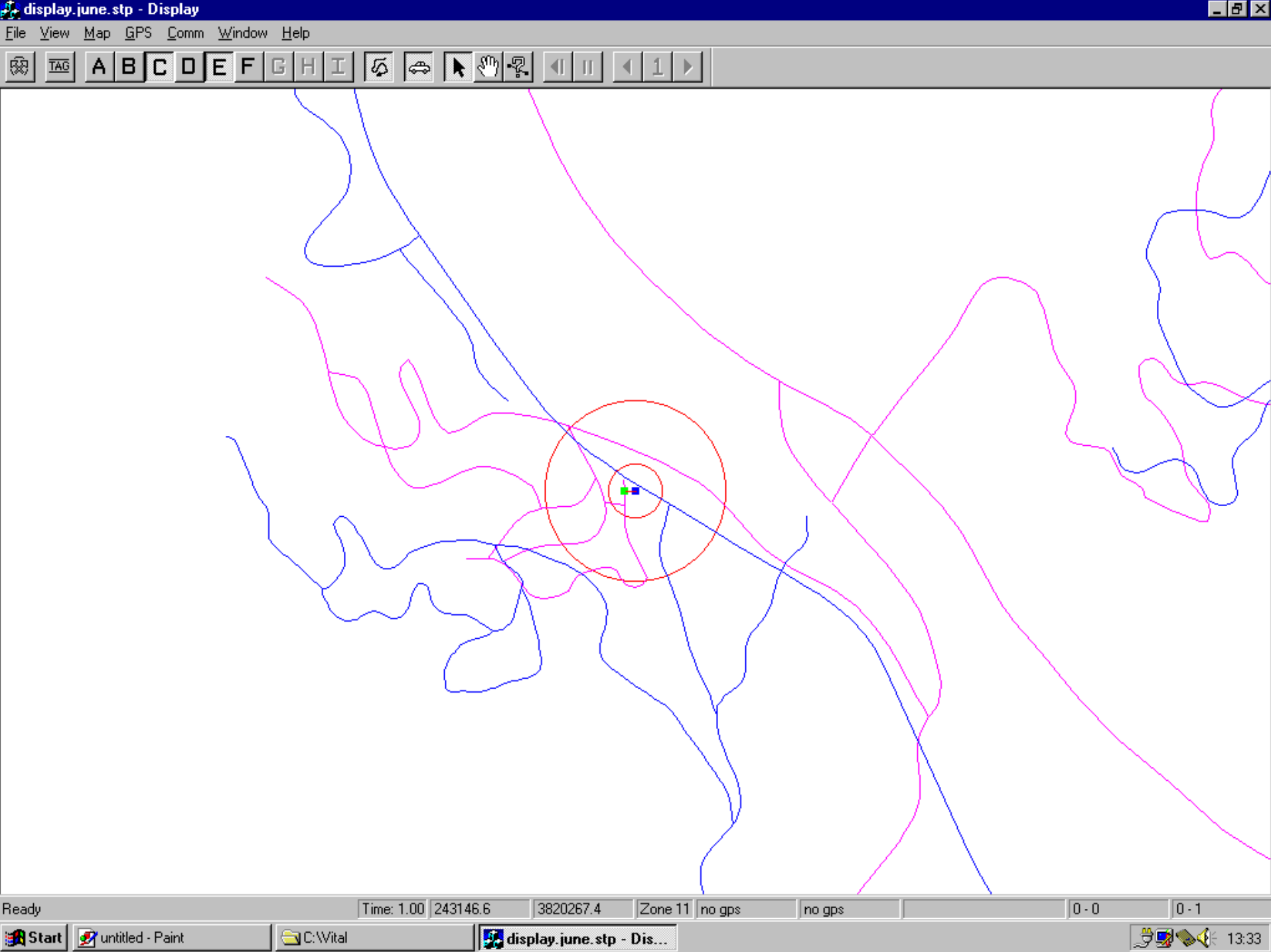
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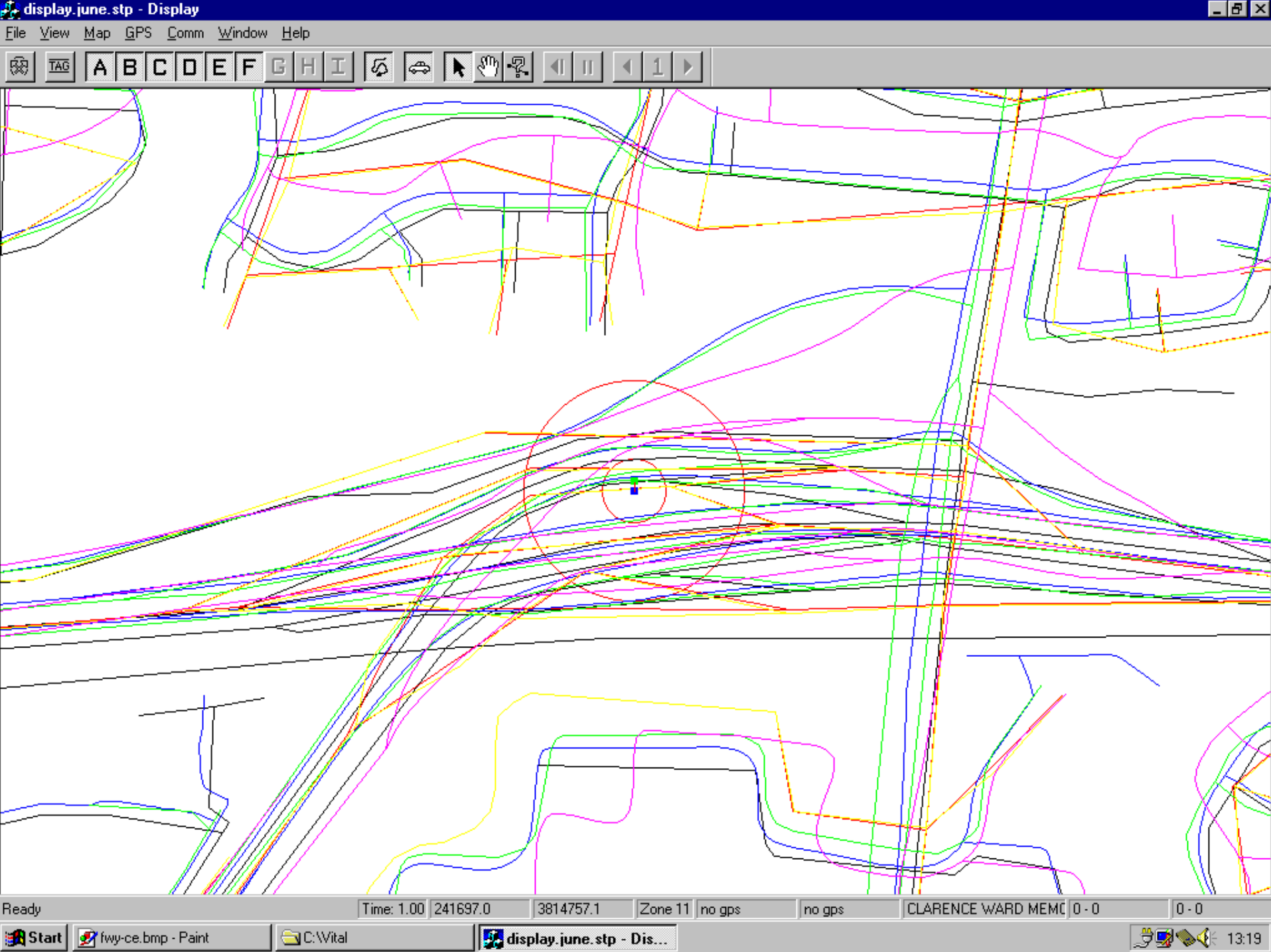
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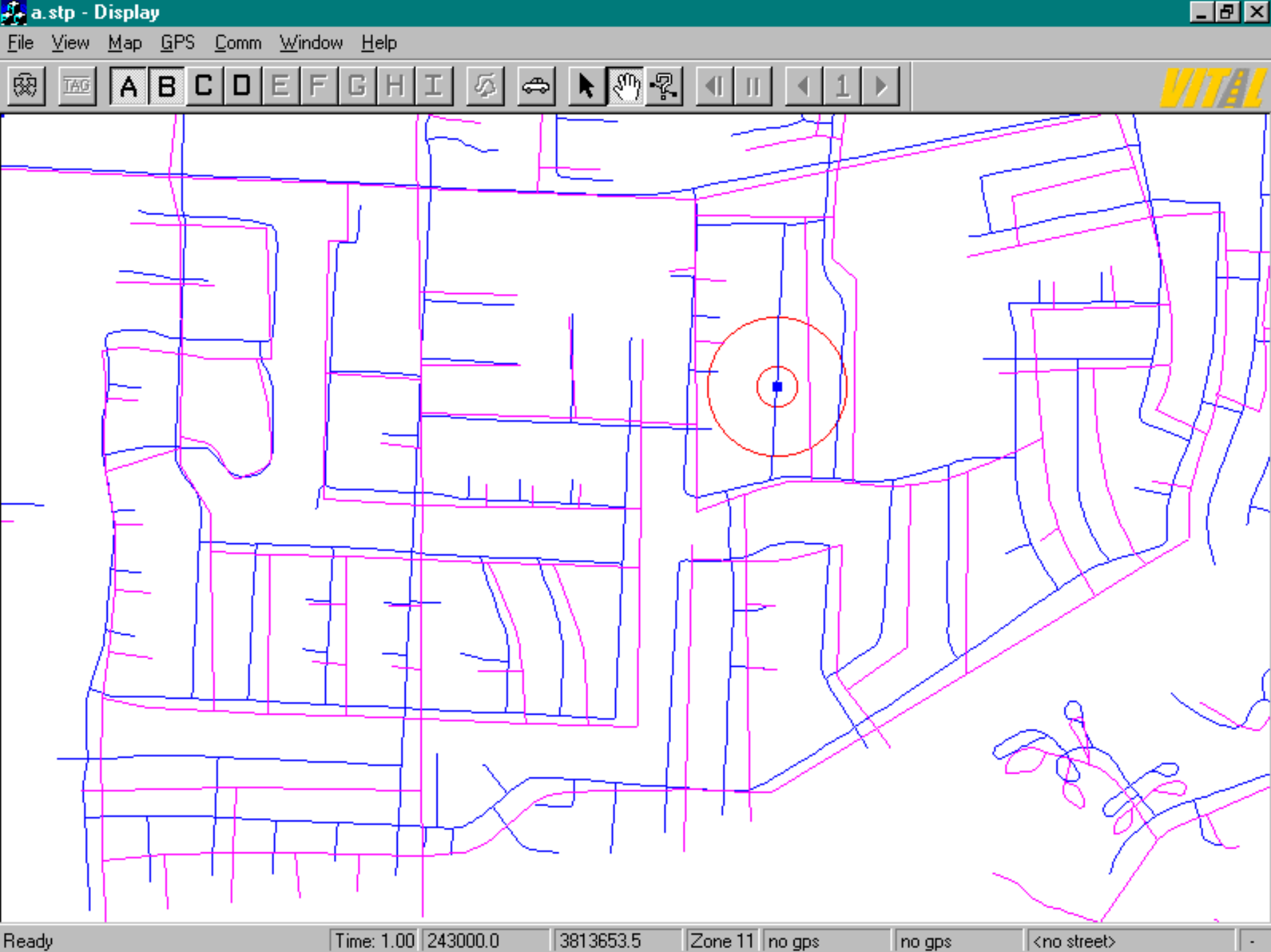
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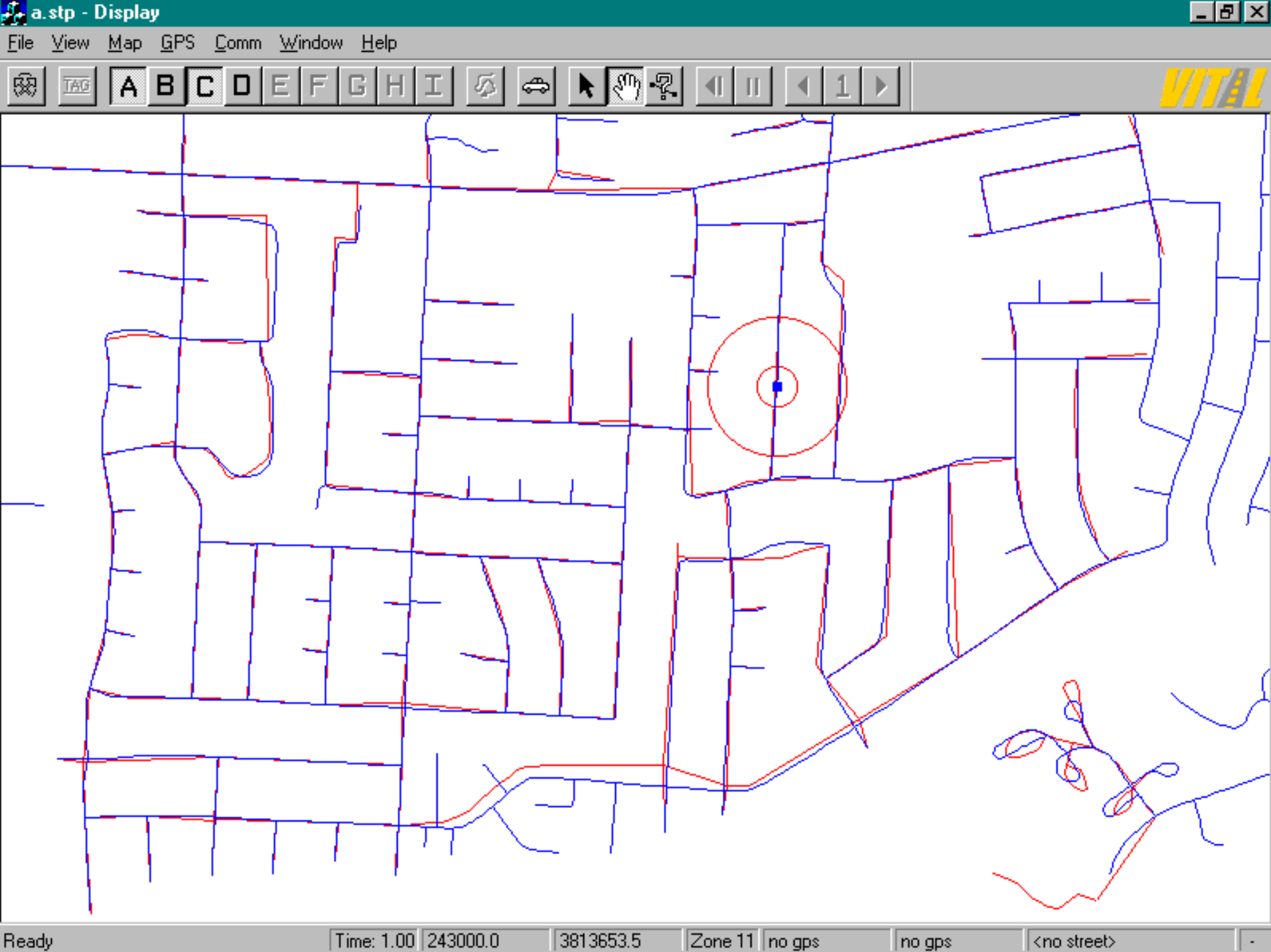
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3813653.5
Zone 11
no gps
no gps
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Options for **p**

- Where to process?
  - server or client, which server?
  - published services
    - directories
    - www.geographynetwork.com
    - evolving g.net
  - description standards
    - UDDI: Universal Description, Discovery and Integration
    - WSDL: Web Service Definition Language

p and u

- $||\mathbf{p}-\mathbf{u}|| = 0$
  - computing in the client
    - using local data, $||\mathbf{u}-\mathbf{d}|| = 0$
    - using remote data
- $||\mathbf{p}-\mathbf{u}|| > 0$
  - send data to the service from the client
  - link a remote service to a remote data source, $\mathbf{p} \neq \mathbf{u}$, $\mathbf{d} \neq \mathbf{u}$

Costs and benefits

- More cycles available remotely
  - integrating and exploiting waste cycles
  - the Grid
  - SETI
- Intellectual property issues
  - intellectual value of service
  - risk of dissemination
  - commercial value
- Update, versioning issues
  - distributed service has versioning problems
- Process coupled to data, well defined

geography network explorer - Netscape
geography network explorer
Help
search
browse
1 Type place name & press Go:
GO
or draw search area :
2 Choose content type:
Geographic Services
Choose content theme:
<All Content Themes>
Optional Keyword (e.g., river):
SEARCH
Search NSDI Clearinghouse
Records Found: 7
Content Found by Search
Geographic Services
Publisher: Tele Atlas North America, Inc.
Content Title: EZ Locate
Coverage Area: United States
Link to Content
View Details
Publisher: Tele Atlas North America
Content Title: ArcIMS Route Server GeoService Demo
Coverage Area: 50 United States
Map Scale: 1:24000
Link to Content
View Details
Publisher: ESRI
Content Title: Place Finder Sample Web Service
Coverage Area: global
Link to Content
View Details

High-priority geoservices

- Geocoding
  - tied to data, update issue
- Gazetteer
  - conversion between general or domain-specific placename and coordinates
  - geoparsing
    - identification and decoding of placename references in text
    - mapping and associating news stories
  - queries based on placenames
    - how far is the capital of Belgium from the capital of France?
- What else, is there a general model?

Conclusions

- Location is increasingly important in cyberspace
  - four locations are relevant to e-government
- New technologies are making spatially enabled e-government more and more attractive
  - standards and protocols facilitate sharing data and services
- Vertical integration, knowing where to look remain unsolved problems
  - legacies of previous technologies
  - requiring creative solutions