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The Surveyor: Charting the World's Course- What's in the Future?

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National Geodetic Survey
National Ocean Service
National Oceanic and Atmospheric Administration
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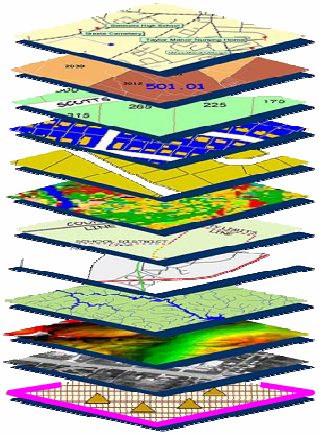
Surveyors Provide the Foundation for all Geospatial Positioning Products and Services

Geodetic control is the foundation required for all geospatial products.

National surveying agencies provide their users with a consistent national coordinate system, which includes:

- **Latitude**
- **Longitude**
- **Height**
- **Scale**
- **Gravity**
- **Orientation**

Geodetic Control is the **Critical Layer** for GIS Applications



and how these values change with time.

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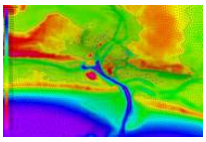
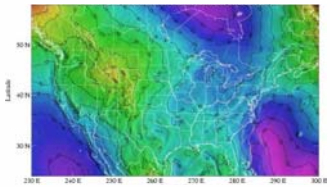
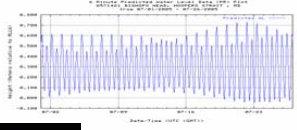
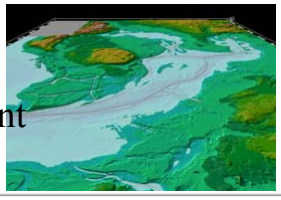
What do you need to develop geospatial products and services?

- Water level data
- Geodetic Data
- Geophysical data
- Models
- Transformation programs
- GIS applications
- Subsidence/Crustal Movement









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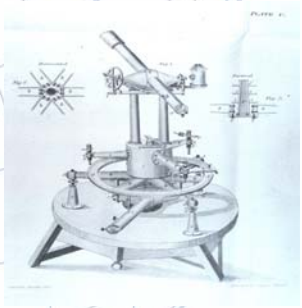
Past Tools - Angle Measurement



Troughton 24" theodolite

Parkhurst Theodolite

Wild T-3 Theodolite

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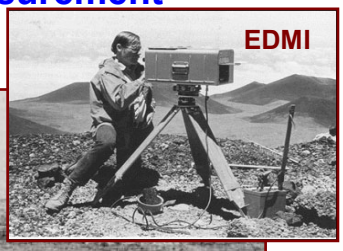
Past Tools - Distance Measurement

Taping a base line



EDMI

Measuring a base line w/ a bar

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Past Tools - SPIRIT LEVELING

Leveling party using spirit leveling techniques.

Automatic Level

This is the high accuracy electronic level. It scans a special barcode rod to determine an exact height.

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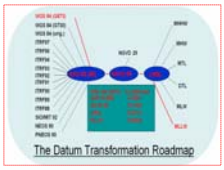
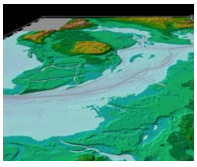
Surveyors Have Three Basic Capabilities that they provide to Geospatial Users

Geospatial Infrastructure

Models & Tools





Outside Capacity

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What I See: Percent of Resources Allocated to These Capabilities

Infrastructure - 80%

Models & Tools – 15%

Outside Capacity – 5%

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Evolving Geospatial Infrastructure in US

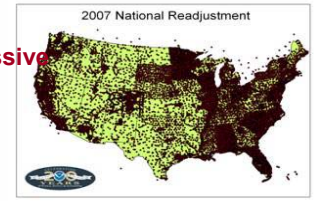
1 Million Monuments

(Separate Horizontal and Vertical Systems)

→

70,000 Passive Marks

(3-Dimensional)



Passive Marks

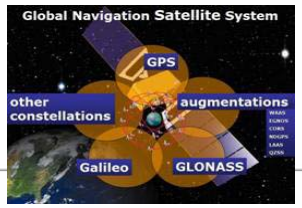
(Limited Knowledge of Stability)

→

CORS

(Time Dependent System Possible; 4-Dimensional)

GPS CORS → GNSS CORS



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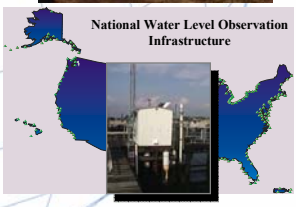
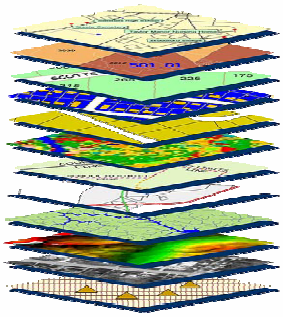
Resulting In:

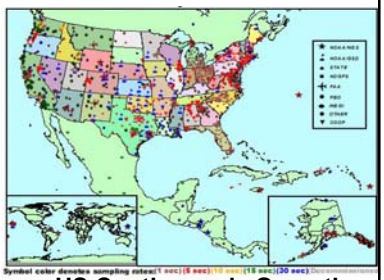
An accurate four-dimensional Spatial Reference System enabling users to address their geospatial requirements

Observations





Geodetic Control



US Continuously Operating Reference Station (CORS) Network provides updated geopositional reference

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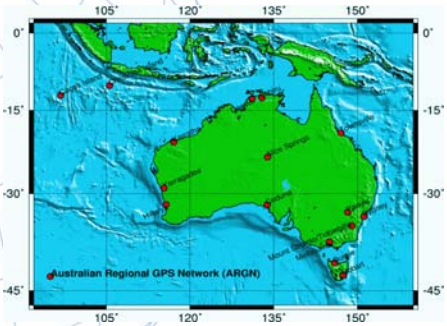
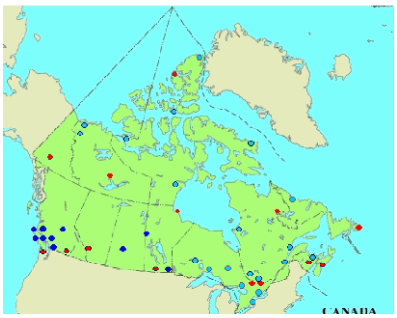
Examples of other CORS Networks



Australian Regional GPS Network



Canada Active Control Network

Examples of International Assistance with CORS Development

GONDOR, ETHIOPIA

ZANDERIJ, SURINAME

SAN JOSE, COSTA RICA

COTONOU, BENIN

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Expanding Models and Tools

Data Submitted Via a Complex Data Entry Process

(horizontal and vertical separate processes)

→ Simplifying Data Processing

Online Positions User System (OPUS)

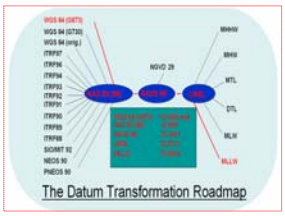
Submit GPS Data via Internet

3-Dimensional

Individual Systems Manually Linked by Users

→ On the Fly Integration

VDatum: Transforms Geospatial Data from Different Sources into a Common System.

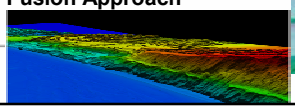


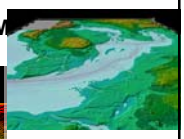
Data Manually Converted to GIS Format

→ GIS Automation

Products and Services in GIS Format. M

Sensor Data Fusion Approach





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OPUS HomePage - Microsoft Internet Explorer provided by National Geodetic Survey

Address http://www.ngs.noaa.gov/OPUS/ Go File Edit View Favorites

Online Positioning User Service

OPUS Upload | What is OPUS | Using OPUS | Recent Solutions | Faqs | OPUS Policies | Contact OPUS

- What is OPUS
- Using OPUS
- Recent Solutions
- FAQs
- OPUS Policies
- Contact OPUS

Recent Developments

[Nov 10, 2004] Format of the OPUS data sheet is changed to provide space for the

1. Ente
2. Ente
3. NON Sele
4. 0.0 Ente

You've got mail!

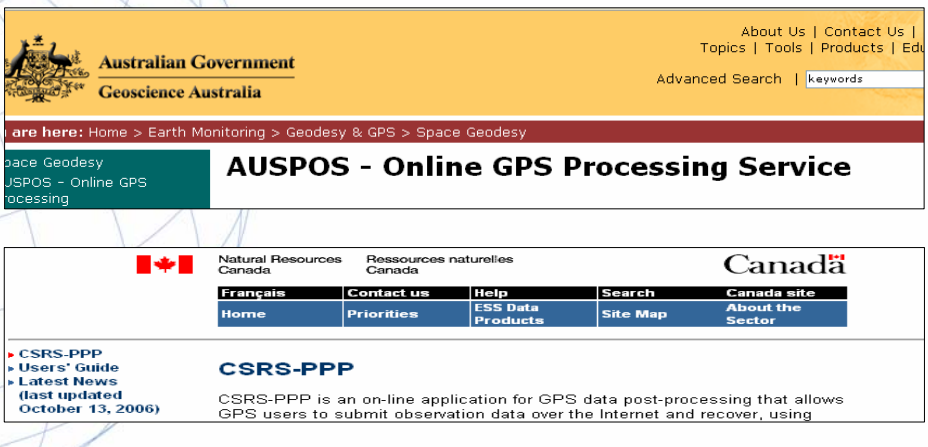
OPUS solution

the basic OPUS

Upload File

Your data must be dual frequency data (L1 and L2) and a minimum of 2 hours of observations is recommended.
Your collection rate must be 1,2,3,5,10,15 or 30 seconds.

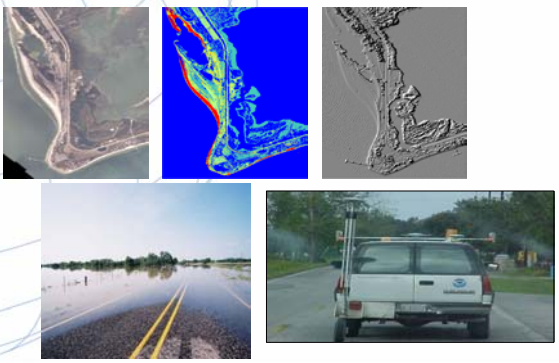
Other Examples of Online Positioning Services



Resulting In:

Simple, user-friendly, on-the-fly integration of data and data products enabling decision-makers to make better, more informed decisions, and generate cost-effective solutions.

Multi-sensor data fusion



Floodplain mapping

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Building Outside Capacity

- Obtaining a Better Understanding of Societal Outcomes
- Retraining Workforce From Being "Doers" to Trainers
- Working with Customers to Develop New Technologies
- Multi-Discipline Groups Working Together to Achieve Outcomes
- Informing Scientific Organizations of Customers Requirements
- Increasing Role in Shaping National/International Geospatial Policy

- Changing From Central Control to Local Involvement

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Resulting In:

Reduction of redundant work within and among agencies, providing operational efficiencies, and working with private industry and government to develop National Geospatial Policy.

Obtaining high-accuracy geo-referenced data using an array of novel GPS technologies

Training volunteers on using elevations to guide wetland restoration activities

Increased efficiency and better environmental stewardship through precision agriculture

Restoration of critical commerce infrastructure

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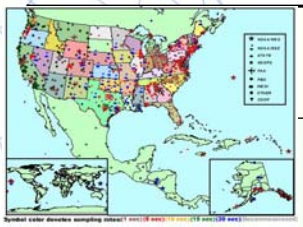
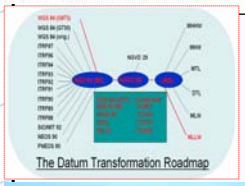
Predicted Typical Percent of Resources Allocated to Capabilities in the FUTURE





Infrastructure - 20%

Models & Tools – 30%

Outside Capacity – 50%

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Infrastructure - 20%

Models & Tools – 30%

Outside Capacity – 50%

What does this mean to the surveyor and the geospatial user community?

How do we get there?

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Support for New Customers

- **With the help of GNSS, more accurate DEMs can be produced to support Community Resiliency efforts by better detecting local relative sea-level rise and water-levels in flood prone areas.**
- **DEMs in coastal ecosystems provide a better understanding of a wetland's ability to serve as a storm-surge buffer.**

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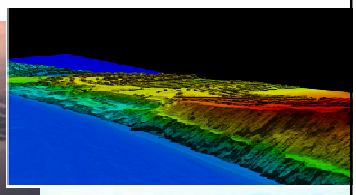
Multi-Sensor Data Fusion Approach of Geodetic and Remote Sensing Technologies



- Coastal zone managers are able to make more informed decisions about fisheries programs, stock assessments, algal blooms, and other issues affecting the health and vitality of coastal ecosystems.

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Meeting Future Needs Requires a CULTURAL CHANGE

CULTURAL CHANGE:

- Outcome driven
- Customer focused
- An integrated and collaborative organization
- A retrained & retooled workforce

Infrastructure - 20%

Models & Tools – 30%

Outside Capacity – 50%

Some of the Outcomes We Need to Focus On

- Coastal Inundation
- Drought
- Earthquake
- Flood
- Human & Ecosystem Health
- Hurricanes
- Landslide and Debris Flow
- Tornado
- Tsunami
- Volcano
- Heat Waves
- Technological Disasters
- Wildland Fires
- Winter Storms

Some Customers We Need to Listen to and Work With

- Emergency Managers
- Planners and Developers
- Insurance Industry
- Agricultural Industry
- Construction Industry
- Environmental Engineers
- Coastal Managers
- Local governments
- Tribal governments
- International Organizations
- Academia
- Professional Organizations
- Private Sector
- Foreign Counterparts

How Can We Make This Happen?

- Help shape geospatial policy by being more involved in positions that create national and international policy
- Work with other disciplines to achieve agreed upon outcomes
- Retrain workforce from being the "doers" to being the teachers and trainers
- Set goals and actions that require collaboration with other organizations to achieve a common outcome
- Develop cross-discipline work plans that will achieve agreed upon outcomes

"Just look what we can accomplish when we work towards a common goal...LUNCH!"

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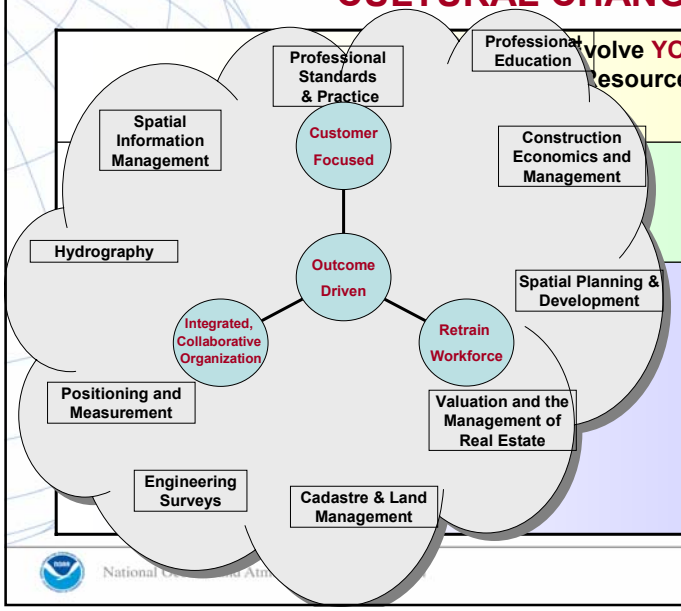
Meeting Future Needs Requires CULTURAL CHANGE



volve YOUR Infrastructure to Decrease
esources Required to Maintain and Operate

Enhance Models and Tools for YOURSELF and OTHERS

Build Outside Capacity so OTHERS use YOUR Infrastructure, Models and Tools.

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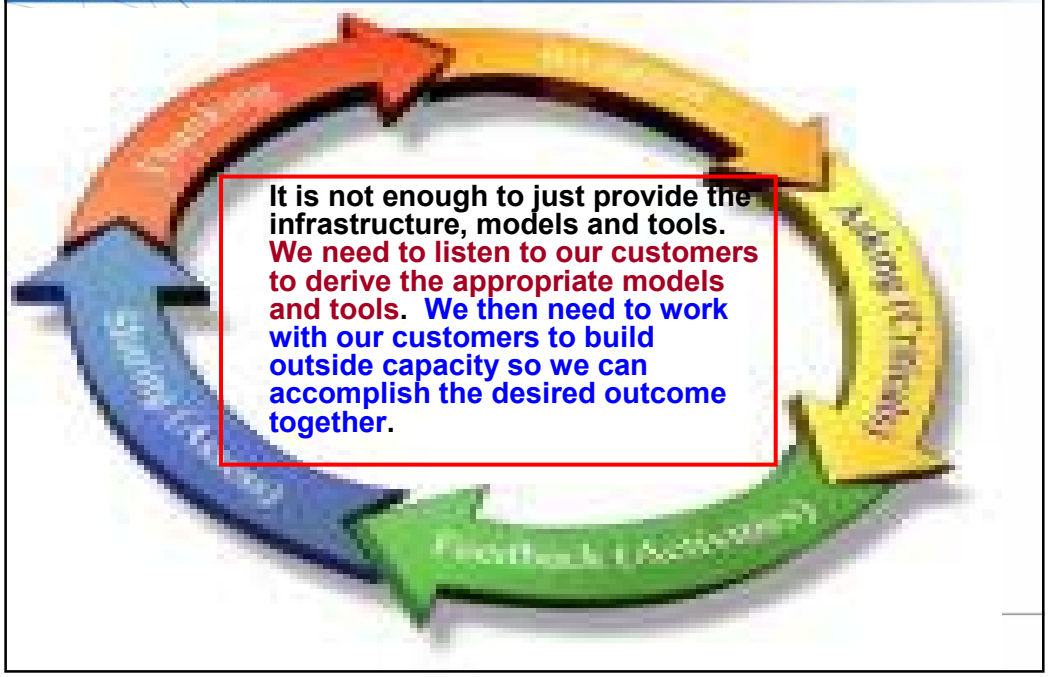

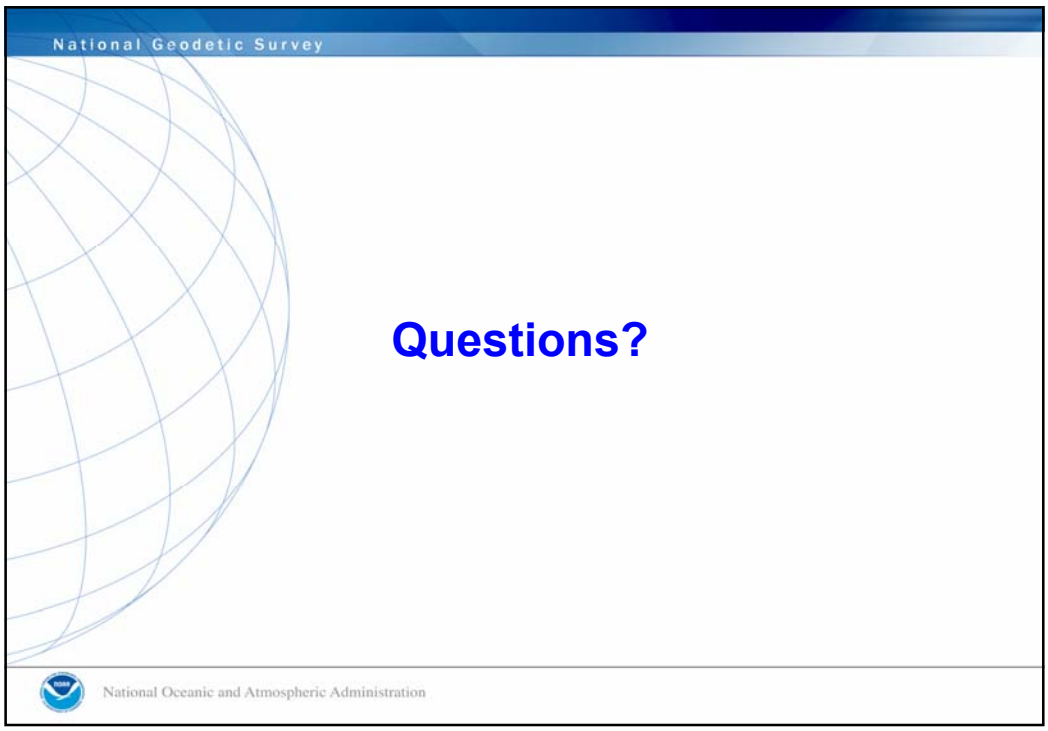
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Questions?
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