Upcoming Changes to Federal Survey Control and Standards

Presented at
County Engineer's Association of Ohio
Land Records Modernization Conference
Columbus, OH
June 13, 2017

Presented by:
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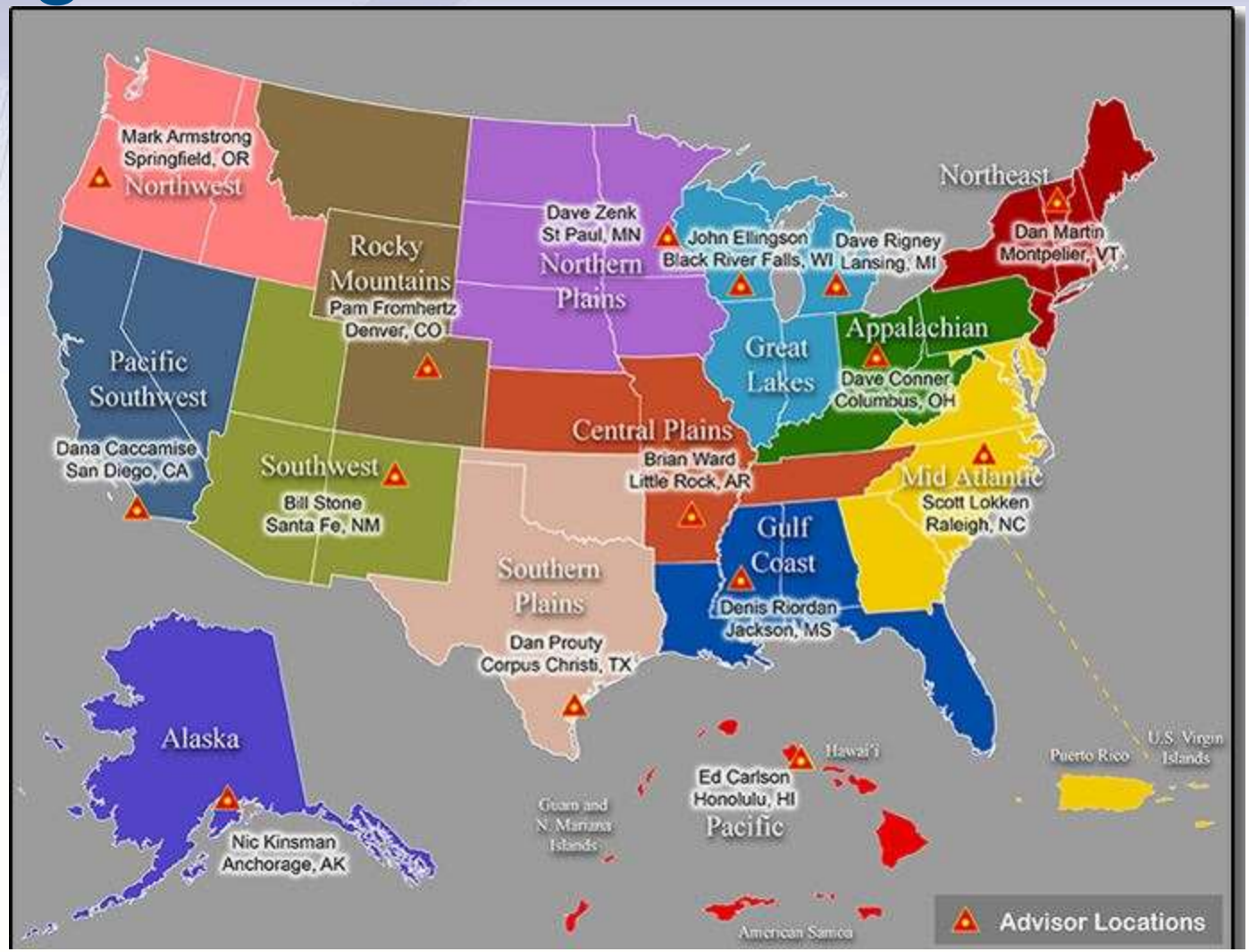
NGS Regional Geodetic Advisors

Serve as liaison *between* NGS and the user community … it's a two-way street!

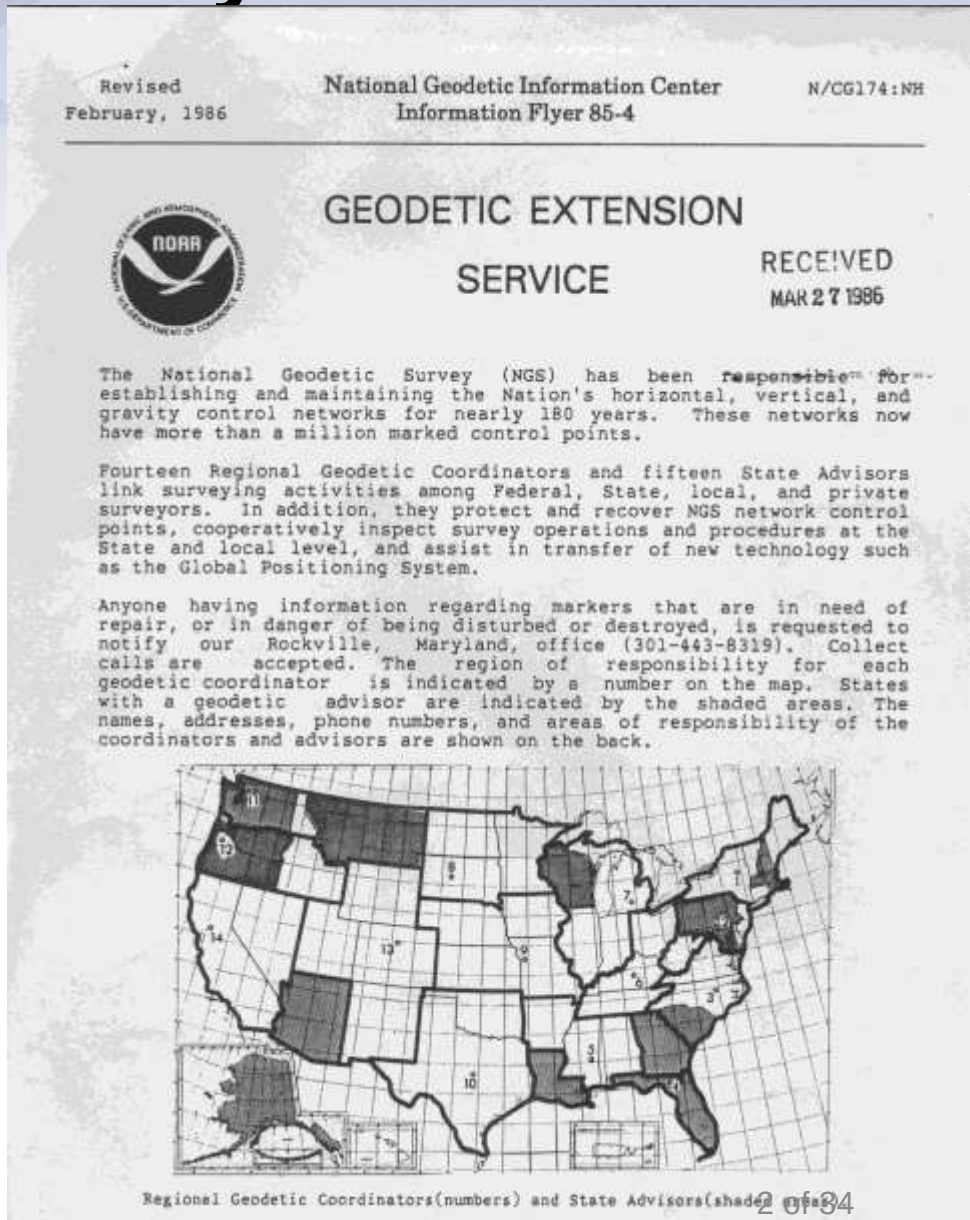


NGS Outreach - history and news

1950's -1980's = Mark Maintenance, aka Network Maintenance … directed to cooperate with City and County engineers

1980's –> Mark Maintenance evolved into Regional Geodetic Coordinators and State Advisors

2016 -> State Advisors became today's Regional Geodetic Advisors



Revised
February, 1986

National Geodetic Information Center
Information Flyer 85-4

N/CG174:NH

GEODETIC EXTENSION

SERVICE

RECEIVED
MAR 27 1986

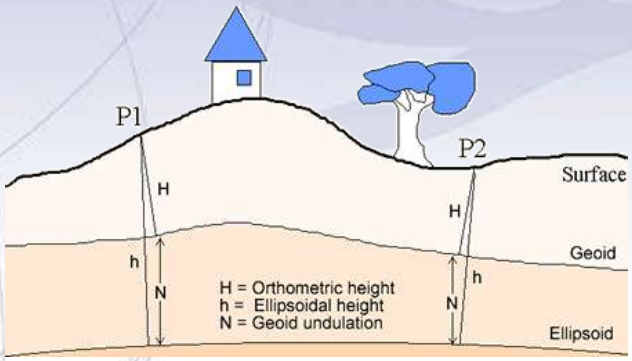
The National Geodetic Survey (NGS) has been responsible for establishing and maintaining the Nation's horizontal, vertical, and gravity control networks for nearly 180 years. These networks now have more than a million marked control points.

Fourteen Regional Geodetic Coordinators and fifteen State Advisors link surveying activities among Federal, State, local, and private surveyors. In addition, they protect and recover NGS network control points, cooperatively inspect survey operations and procedures at the State and local level, and assist in transfer of new technology such as the Global Positioning System.

Anyone having information regarding markers that are in need of repair, or in danger of being disturbed or destroyed, is requested to notify our Rockville, Maryland, office (301-443-8319). Collect calls are accepted. The region of responsibility for each geodetic coordinator is indicated by a number on the map. States with a geodetic advisor are indicated by the shaded areas. The names, addresses, phone numbers, and areas of responsibility of the coordinators and advisors are shown on the back.

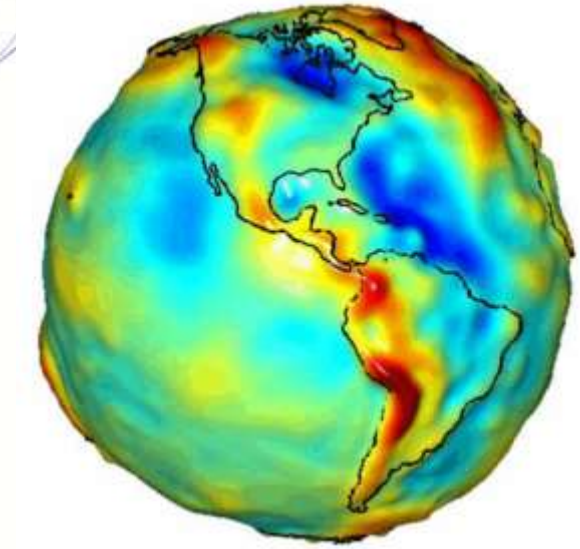
Regional Geodetic Coordinators(numbers) and State Advisors(shaded areas)

What is Geodesy?



Geodesy is a foundational science that defines position & height

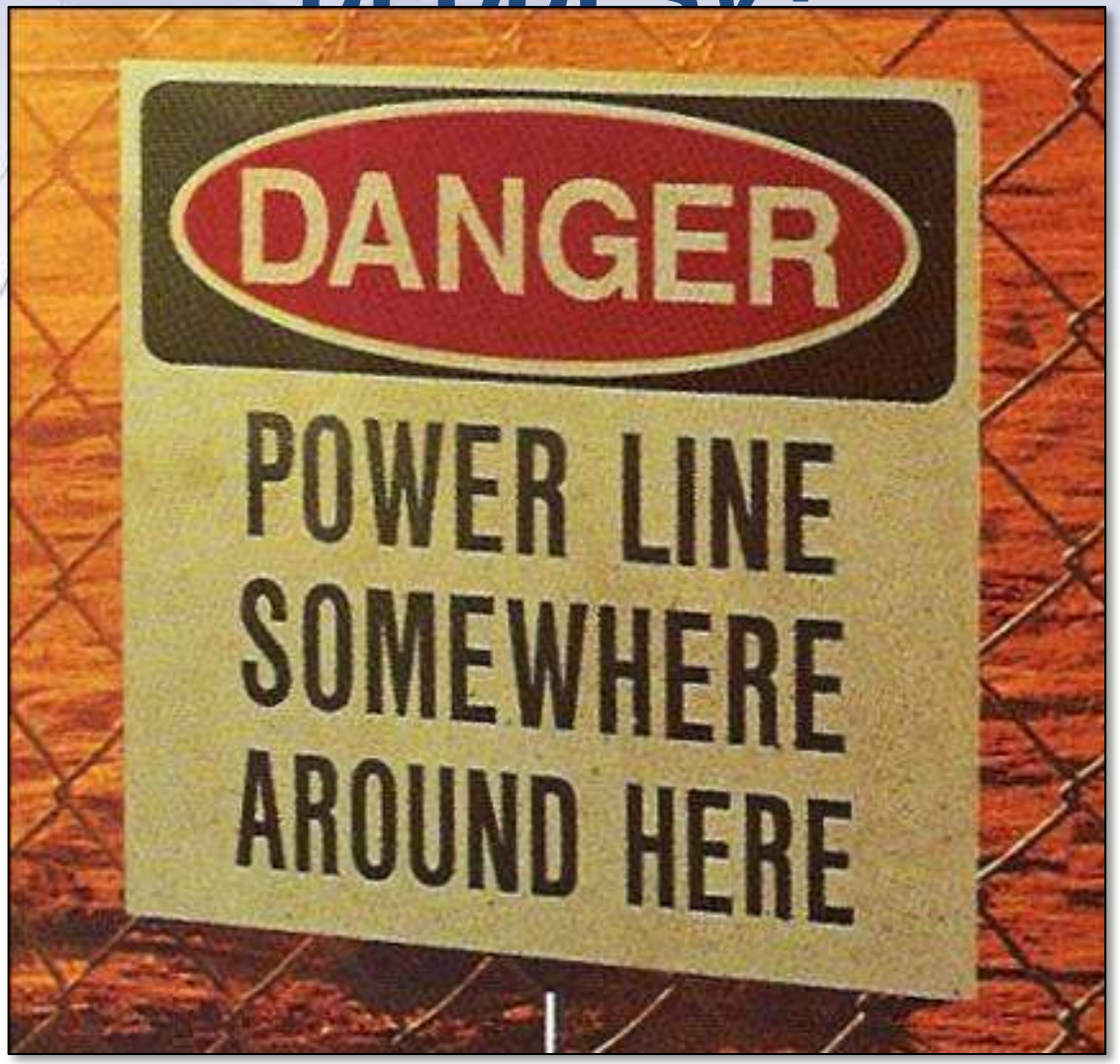
Why is Geodesy important?



The Earth has an irregular surface and is difficult to model.

Accurate positions are required for a wide variety of applications

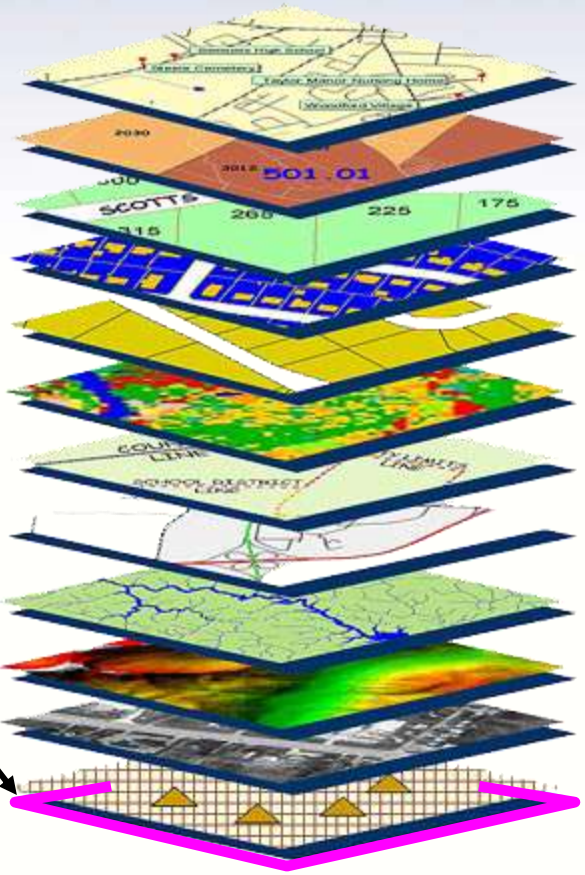
Why should we care about *geodesy?*



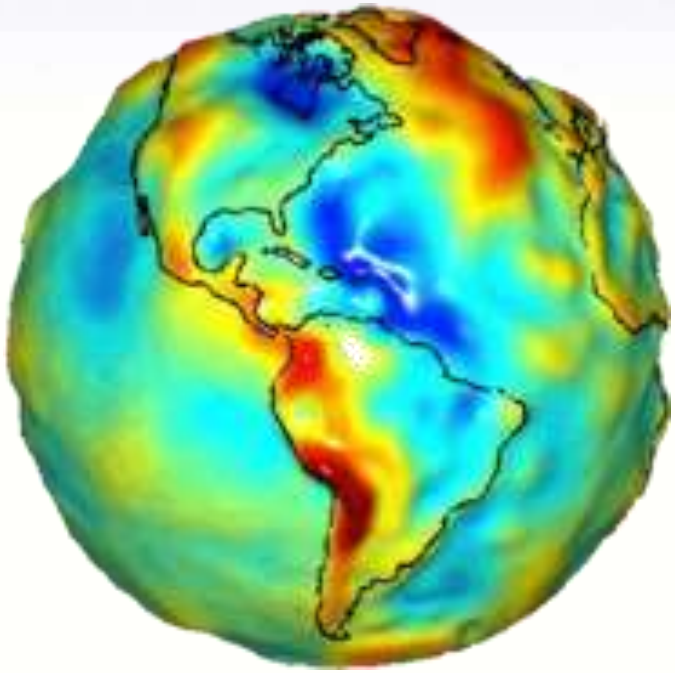
Accurate positioning begins with *accurate* coordinates

Geodetic control is the **foundation** for all geospatial products…

Source: Zurich-American Insurance Group



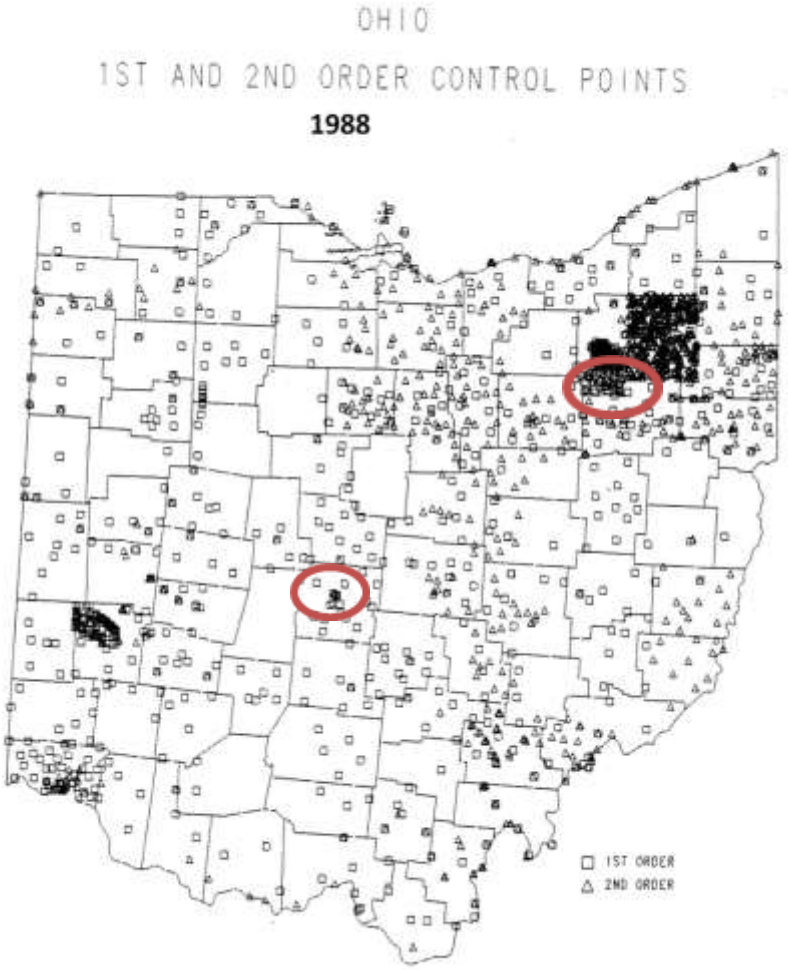
The National Spatial Reference System (NSRS) is a **consistent coordinate system** that defines latitude, longitude, height, scale, gravity, and orientation throughout the United States.



Ohio's Geodesy Firsts

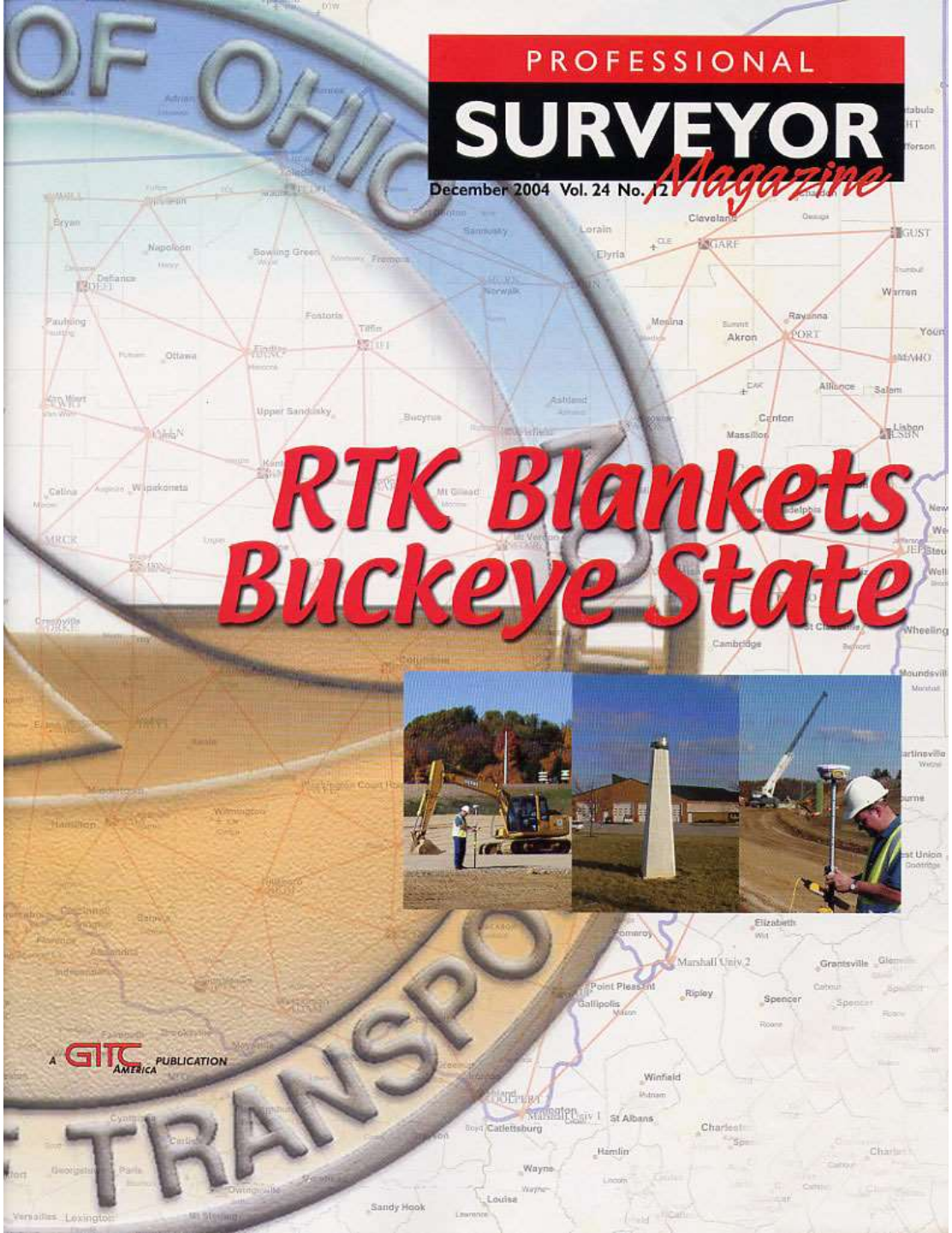
- **Geodesy program in the U.S.**, est. 1952 at **OSU**
- **Network GPS Project**, worldwide, **Summit County** 1983
- **Local government agency with GPS** survey capability, worldwide, **Franklin County** 1987
- **Statewide Real Time GPS network**, by **ODOT** in 2004

Horizontal control *published* by NGS



Prior to *most* GPS projects

Change due to GPS projects



Then came GPS CORS

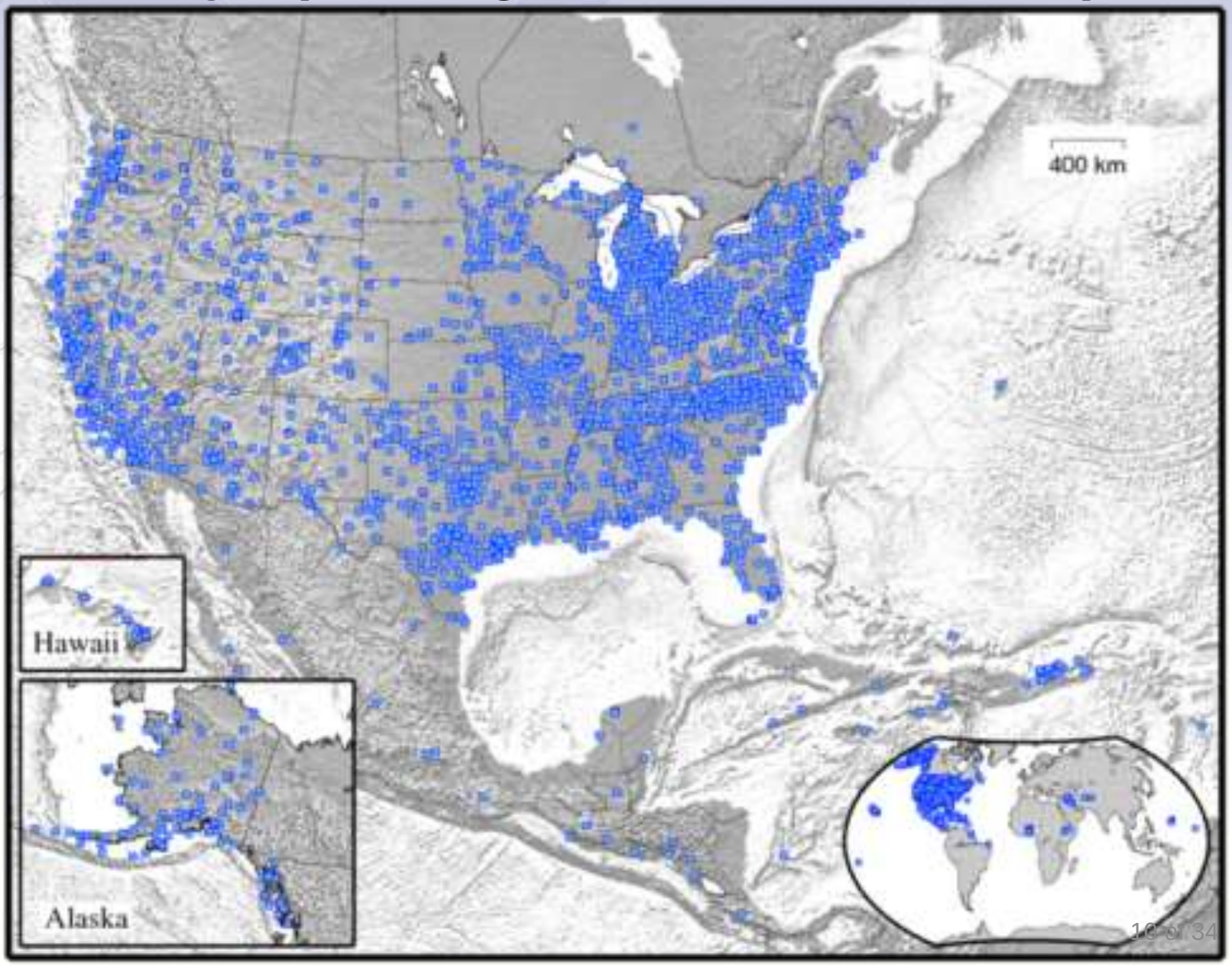
Followed by RTK

Enabling cm *precision* In Real Time … Anywhere, Anytime!

Metadata ever more important!

Continuously Operating Reference Stations (CORS)

~ 2000 Stations



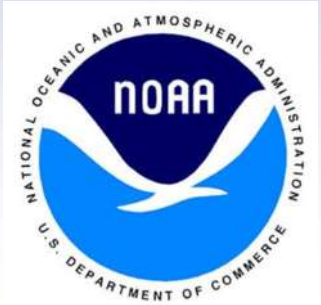
NGS and the NSRS continue to evolve

The National Geodetic Survey (NGS) has been around for a long time

1807
United States
Coast Survey

1878

1970



And the NSRS continues to evolve with us

Passive Control (Monuments)

Active Control (CORS)

SIDNEY est 2001

New Datums Are Coming in 2022

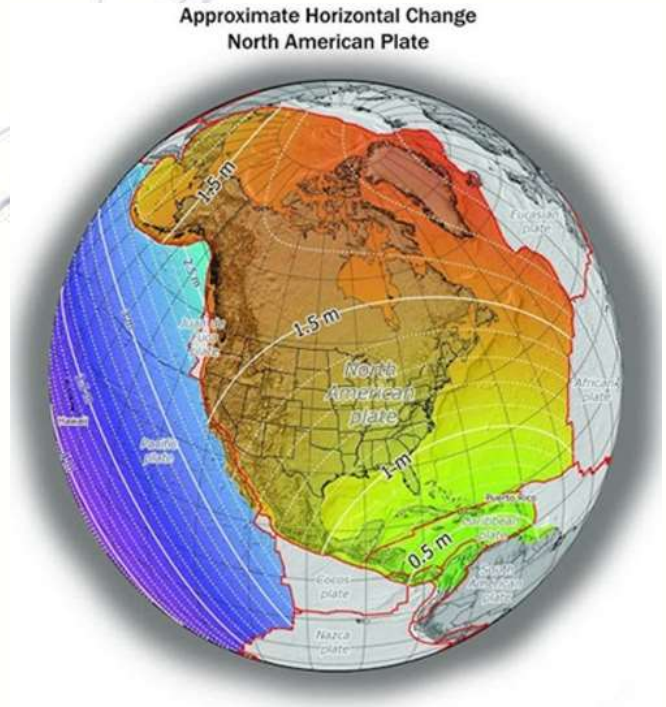
- North American-Pacific Geopotential Datum of 2022 (NAPGD2022) … to replace both NAD 83 and NAVD 88
- Realized through GPS and a geoid model
- NGS will provide transformation tools to convert between datums

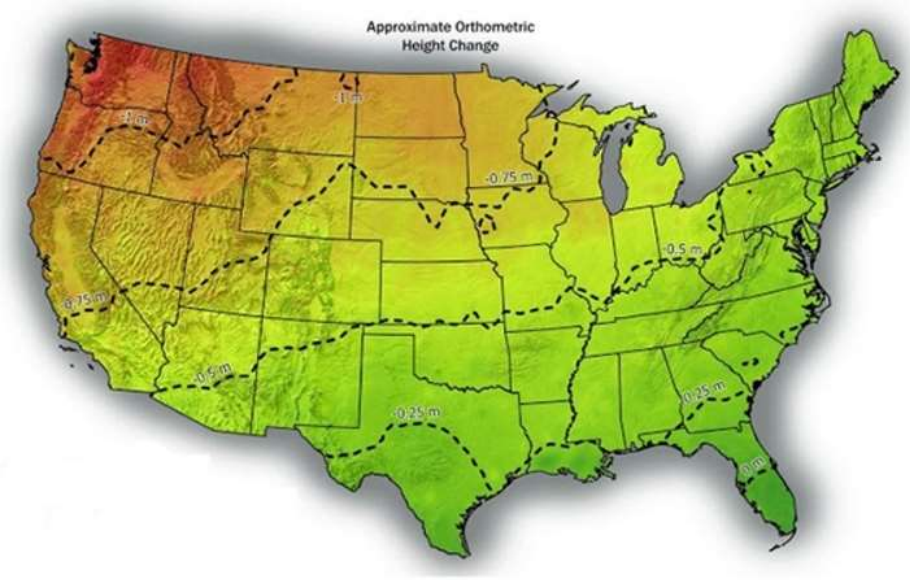
How will the new datums affect you?

- Coordinates Will Change 1-2 meters (3-6 ft)

- Heights Will Change on *average* 50 cm (1.6 ft)

Minimal change in relative difference between nearby points





New Datums

National Geodetic Survey

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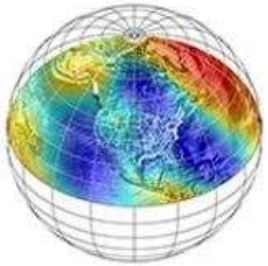
December 1, 2016



Replacing NAVD 88 and NAD 83

NAD 83 and NAVD 88 will be replaced in 2022, and there are many related projects to make sure the transition goes smoothly. Read the **NGS Ten-Year Plan** to learn more and continue to visit this web-page for more information.

What to Expect | Get Prepared

Related Projects | Track Our Progress

Watch Our Videos | Learn More

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Why is NGS replacing NAD 83 and NAVD 88?

NAD 83 and NAVD 88, although still the official horizontal and vertical datums of the National Spatial Reference System (NSRS), have been identified as having shortcomings that are best addressed through defining new horizontal and vertical datums.

Specifically, NAD 83 is non-geocentric by about 2.2 meters. Secondly, NAVD 88 is both biased (by about one-half meter) and tilted (about 1 meter coast to coast) relative to the best global geoid models available today. Both of these issues derive from the fact that both datums were defined primarily using terrestrial surveying techniques at passive geodetic survey marks. This network of survey marks deteriorate over time (both through unchecked physical movement and simple removal), and resources are not available to maintain them.

The new reference frames (geometric and geopotential) will rely primarily Global Navigation Satellite Systems (GNSS) such as the Global Positioning System (GPS) as well as an updated and time-tracked geoid model. This paradigm will be easier and more cost-effective to maintain. Read our white paper for more information.

FAQs frequently asked questions

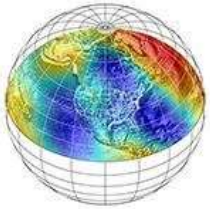
NGS 2017 Geospatial Summit

April 24–25

New Datums: What to expect

National Geodetic Survey

December 1, 2016



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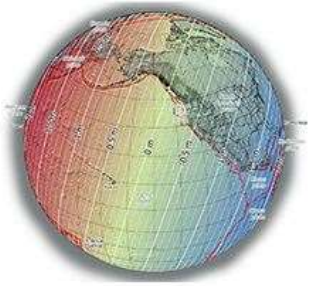
Your coordinates will change

The magnitude of change will vary based on the datum you are using and your geographic location. View the maps below to see the approximate horizontal and height changes when the new reference frames are adopted.

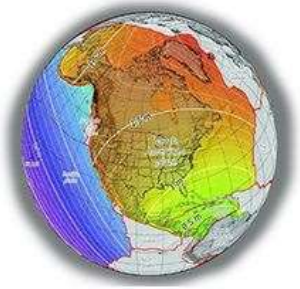
You can also use online tools to calculate the approximate change in your area. Use HTDP to calculate approximate horizontal change and xGEOID models to approximate vertical change.

Approximate Ellipsoid Height Change

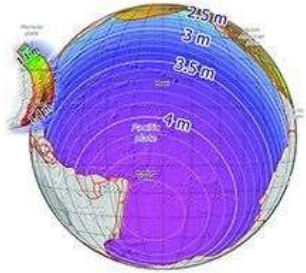


Approximate Orthometric Height Change

Approximate Horizontal Change North American Plate



Approximate Horizontal Change Pacific Plate



Stay Tuned!

Other changes regarding how you access the new datums and transform existing data will await decisions to address challenging technical issues including:

- Adopting a USA-specific reference frame with "plate-fixed coordinates" or "temporal coordinates" using International Terrestrial Reference Frame (ITRF) coordinates and velocities.
- Applying plate rotations models for all applicable frames.
- Determining Continuously Operating Reference Stations or CORS velocities.

New Datums: Get Prepared

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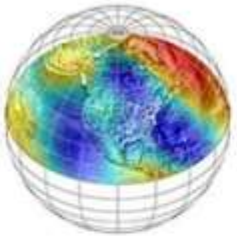
November 30, 2016



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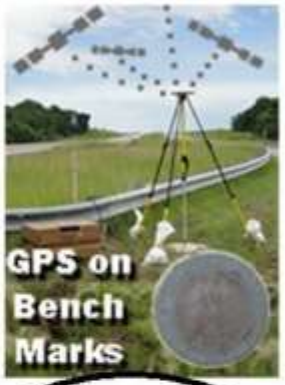
Move to newest realizations.
Tools will be available to transform your data to the new datums from NAVD 88 and the newest realization of NAD 83. The most recent realization for latitude, longitude and ellipsoid height is NAD 83(2011) epoch 2010.00. With respect to orthometric heights, you should transform any legacy data from NGVD 29 to NAVD 88 (see **VERTCON** accuracy in your area).

Obtain precise ellipsoid heights on NAVD 88 bench marks.
Your **adding GPS on Bench Marks** will improve the transformation tool for the new datums.

Require/provide complete metadata for all mapping contracts.
Knowing the datums and epochs for your geospatial files will simplify your datum transformations.

Prepare to change legislation, as needed.
Currently, 48 states have legislation defining their state-based coordinate system, specifically referring to NAD 83 by name. In 2022, NAD 83 will be replaced, and its replacement will not be named NAD 83. NGS, the National Society of Professional Surveyors (NSPS), and the American Association of Geodetic Surveying (AAGS) have formed a joint committee to work on new template legislation to aid states in transitioning their legislation to new wording. **See our flyer to learn more.**



What about state plane coordinates?
NGS will likely define State Plane Coordinates (SPCs) through the same projections and zones associated with NAD 83. See our **FAQ** to learn more.

SPCs are converted from meters using the conversion factor as defined by the individual states who have requested that NGS publish SPCs in feet. The two conversion factors are:

The International Foot
1 inch = 2.54 centimeters

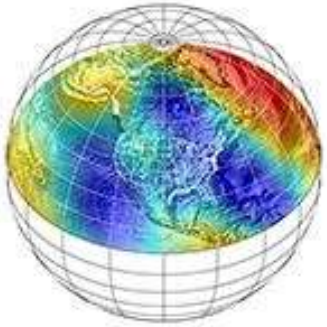
The U.S. Survey Foot
1 meter = 39.37 inches

State Plane Coordinate System (SPCS83) Legislated Units

New Datums: Watch Videos

National Geodetic Survey

October 17, 2016



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What are Geodetic Datums

Learn the basic concepts behind geodetic datums, where they are used, and why it is important to know about and use the correct datums.

How Were Geodetic Datums Established?

Explore the history of geodetic datums in the United States, and how they were established at a national level to assure consistency across mapping applications.

What is the Status of Today's Geodetic Datums?

Examine the use of the current primary geodetic datums used in the US, NAD 83 and NAVD 88, the challenges in maintaining these datums, and the inconsistencies that arise when they are used together with the latest satellite-based mapping technologies.

What's Next for Geodetic Datums?

Look at current plans for developing more accurate horizontal and vertical datums, (referred to respectively as geometric and geopotential datums), the expected benefits and impacts, and the importance of preparing now to adopt these new datums.

View more NGS videos by visiting our **NGS Video Library**.

More info and who to contact

- **Resources are available and continue to be developed at *geodesy.noaa.gov***

- NGS Advisor info … Ross.Mackay@noaa.gov
- Geodetic Advisors https://geodesy.noaa.gov/ADVISORS/index.shtml
- ODOT - www.dot.state.oh.us/Divisions/Engineering/CaddMapping

Questions?