



Preparing for National Spatial Reference System Modernization

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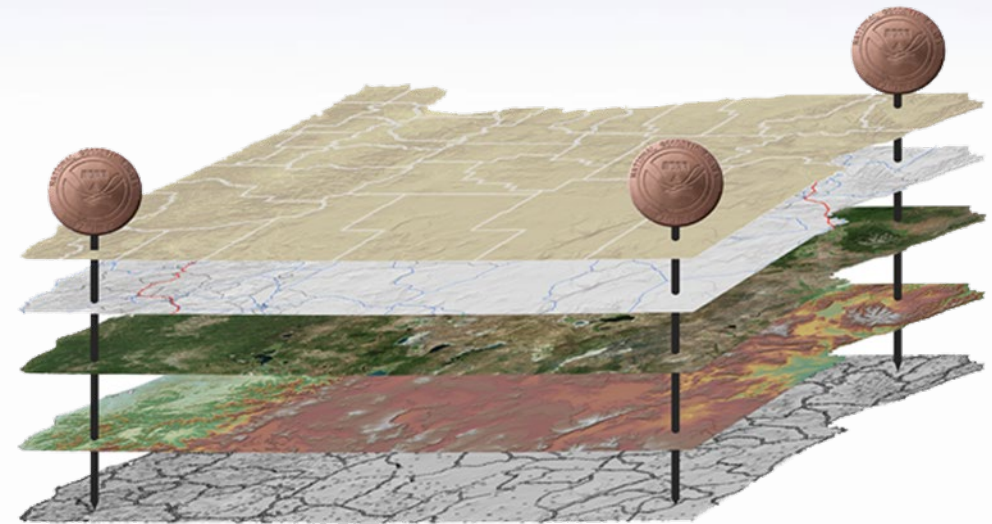
Constituent Resource Manager
DOC/NOAA/NOS
National Geodetic Survey

The National Spatial Reference System (NSRS)

NGS defines, maintains and provides access to the NSRS

Latitude • Longitude •
Elevation • Gravity •
Shoreline Position
+ changes over time

- North American Datum of 1983 (**NAD 83**)
- North American Vertical Datum of 1988 (**NAVD 88**)

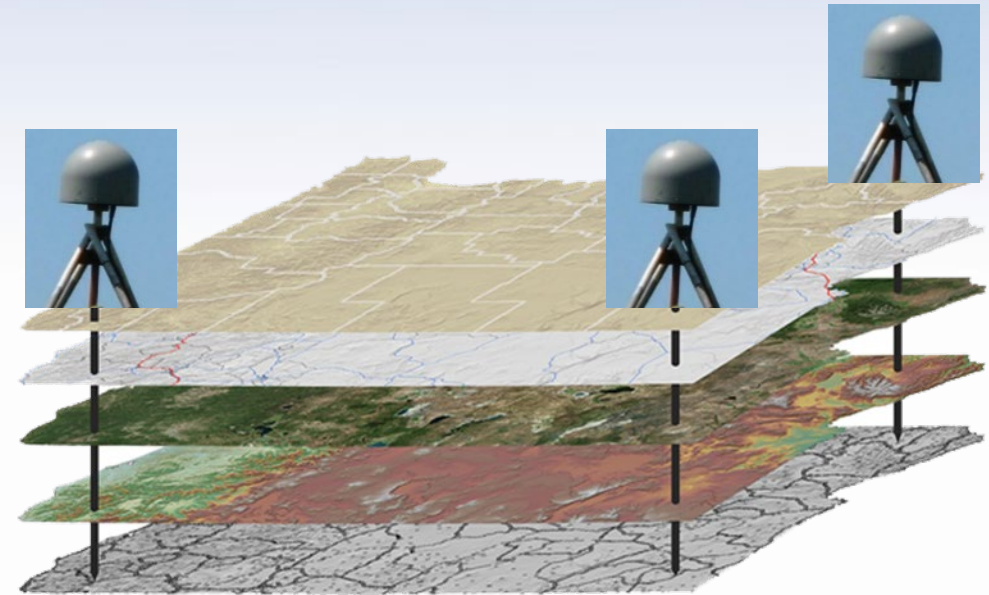


Today's NSRS

The National Spatial Reference System (NSRS)

NGS defines, maintains and provides access to the NSRS

Latitude • Longitude • Elevation
• Gravity • Shoreline Position
+ changes over time



Tomorrow's NSRS

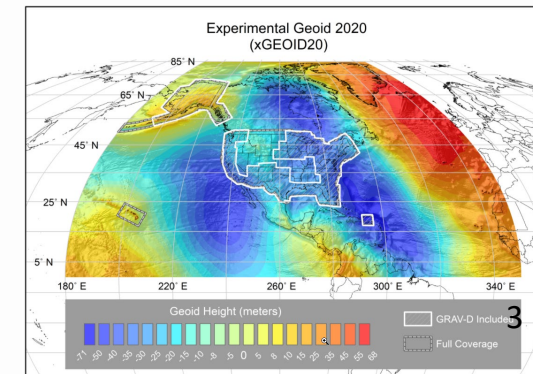
North American Terrestrial Reference Frame (NATREF 2022)

Caribbean Terrestrial Reference Frame (CATREF 2022)

Pacific Terrestrial Reference Frame (PATREF 2022)

Marianas Terrestrial Reference Frame (MATREF 2022)

North America and Pacific Geopotential Datum (NAPGD 2022)



What life will be like in the future

Fast, Accurate, Consistent Elevations Everywhere



Revolutionize professional surveying

No more need for installing and locating bench marks

Absolute, consistent positioning autonomously, anywhere

Vastly improved flood plain mapping

Water flows due to differences in gravity

Critically important in low-lying, flat communities

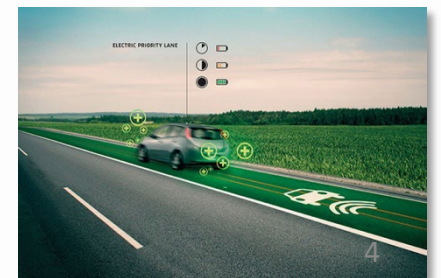


Impacts on infrastructure

Any application requiring precise positioning -- bridges, tunnels, railways, agriculture, navigation -- will be easier and more accurate

Fundamental support for new technologies

Smart Highways for autonomous vehicles in Smart Cities



Practical Impacts

- Every **latitude, longitude and ellipsoid height** will change from its NAD 83 values in the **+/- 2 meter range**
- Every **orthometric height** will change from its NAVD 88 (et al.) values in the **+/-2 meters *median range***, with an **unknown limit** on change due to (as yet) unquantified subsidence impacts
- Published coordinate functions at active control stations will be the primary geodetic control of the NSRS
- Greater integration of NGS tools will improve consistency and reduce confusion

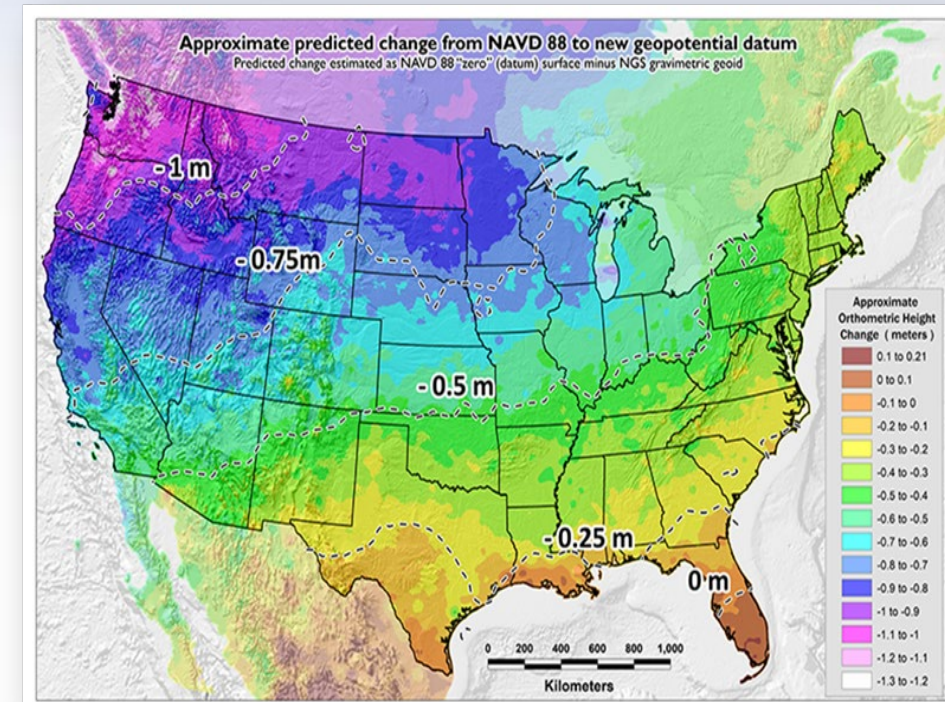
Benefits of Modernizing the NSRS

Why Modernize?

- Current Datums were defined *before* GPS technology, so not geo-centric (~2.2m)
- They rely on old tech & physical survey marks in the ground
- Today's technology requires better accuracy

Modernization will:

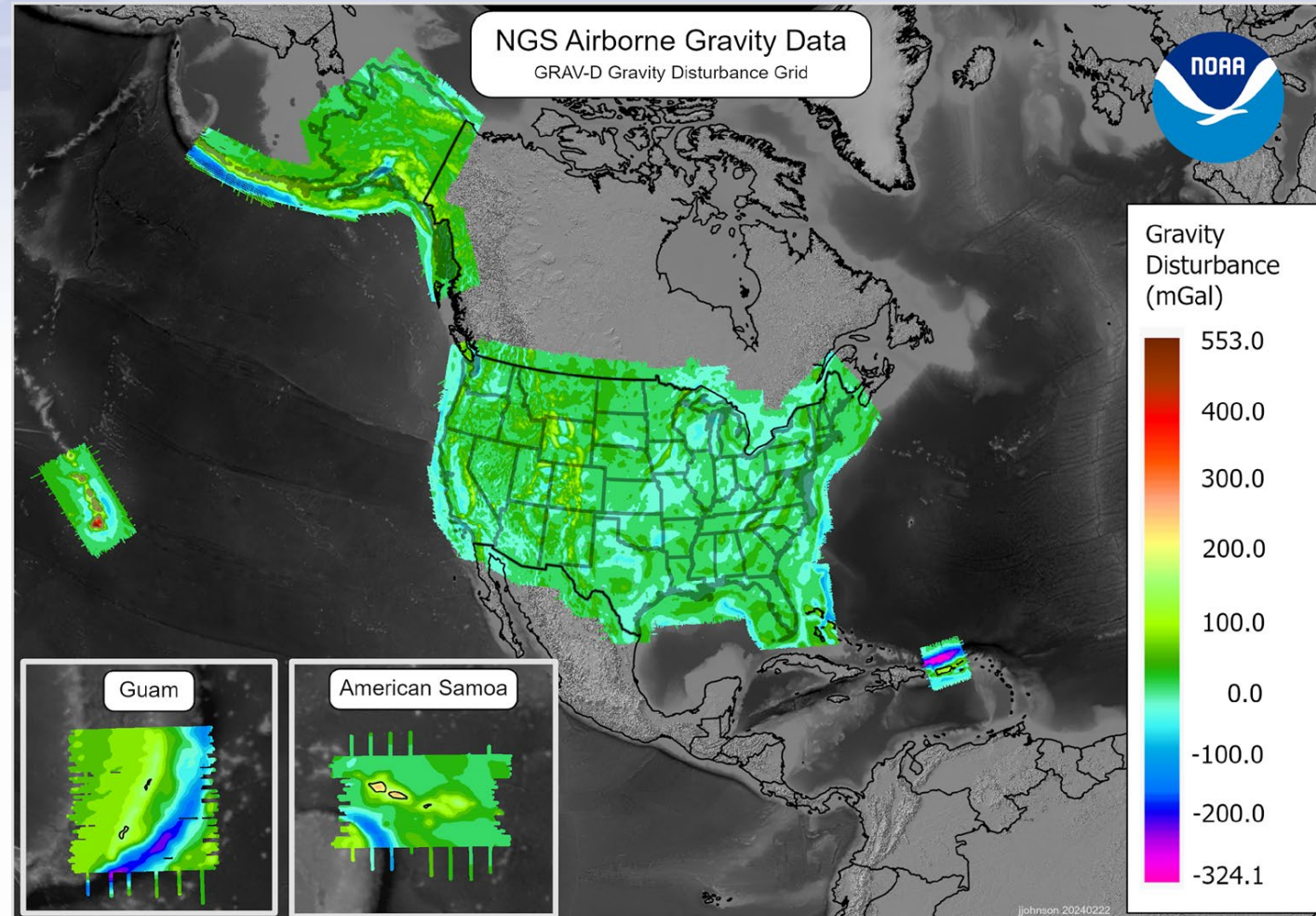
- Improve **accuracy, access, and alignment** of our positioning systems
- Provide ~\$8.7 B in benefits to the nation over 10 years, more for early adopters
- Enable better alignment of NOAA and other data to support emerging needs to address sea level rise, floodplain mapping, and geohazards



GRAV-D is 100% complete!

- Our longest project – started in **2007!**
- 15.7 million sq km
- 4,759 flight lines
- 2.3 million linear km flown
 - Nearly 3 times to the moon and back!!
- Final data set was sent to the geoid team in February

Gravity for the
Redefinition of the
American
Vertical
Datum



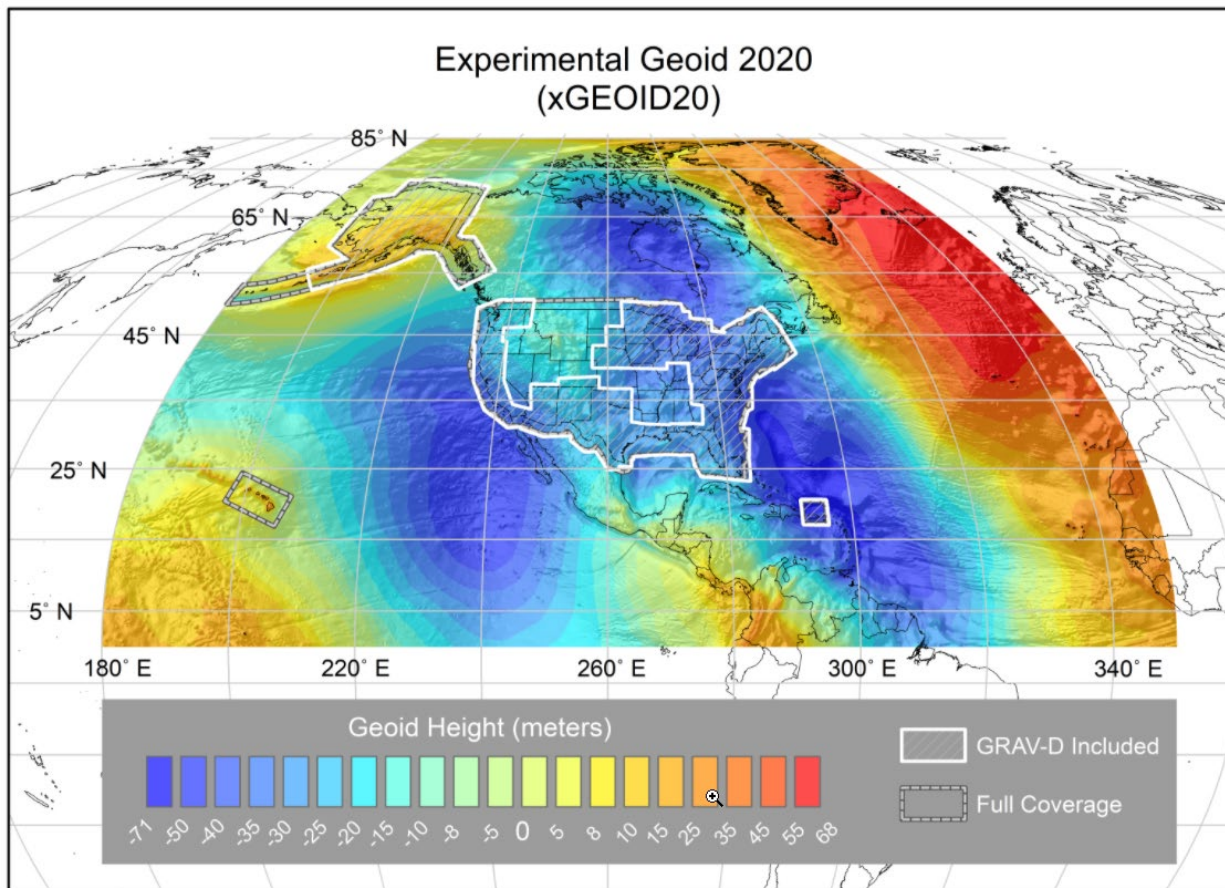
NAPGD2022 Geopotential Datum

North American-Pacific Geopotential Datum of 2022

Not a vertical datum, it is more than just heights.

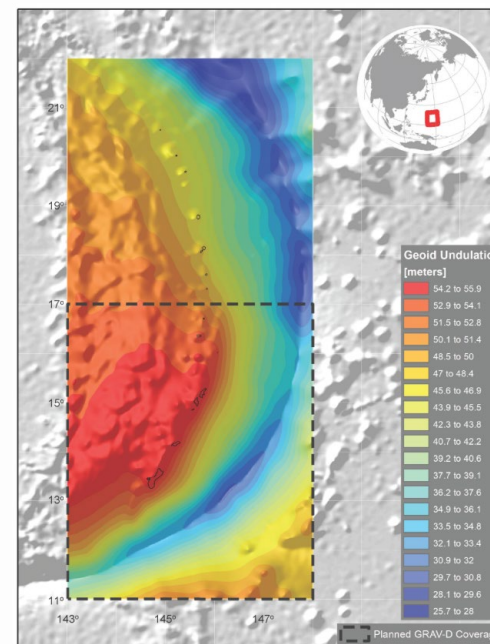
Models include:

- Geopotential
- Deflection
- Gravity
- Geoid

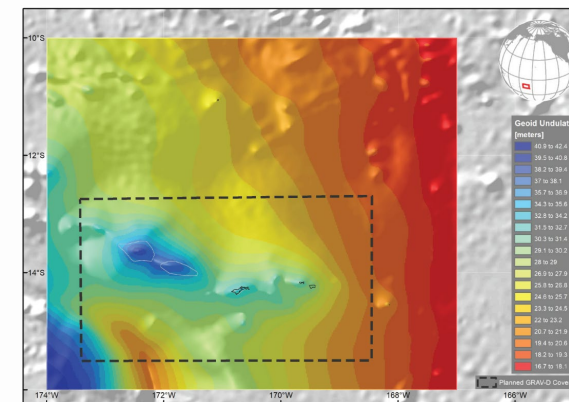


1/4 Earth's Surface

NGAC April 2024



Guam/CNMI

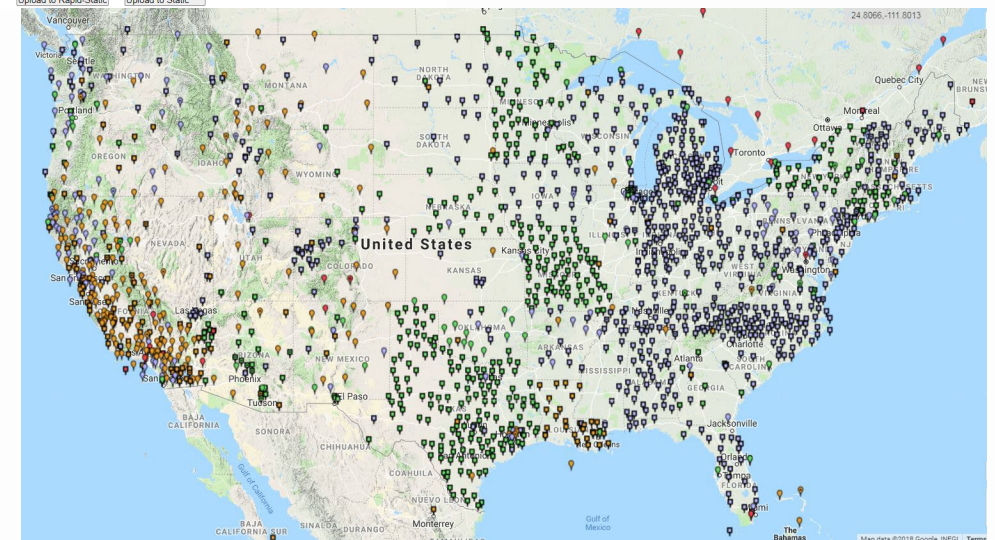
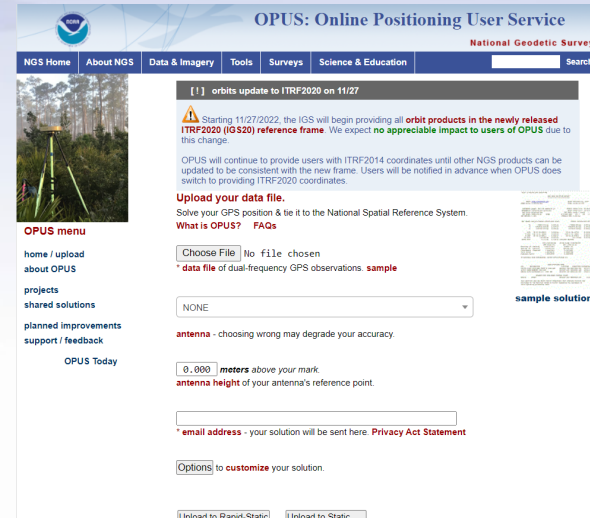


American Samoa

Modernized Access: Through the CORS and OPUS

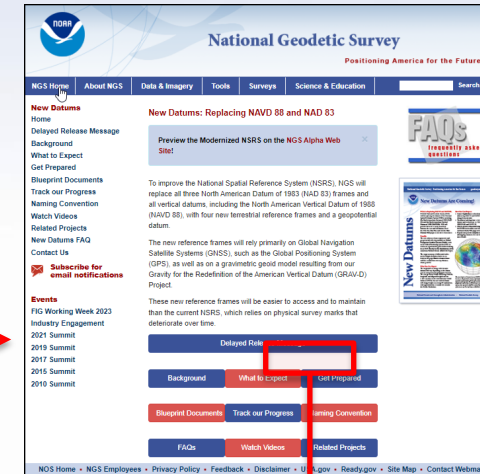
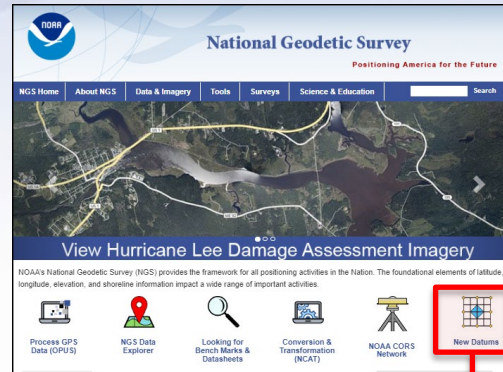
NGS provides data and one definitive coordinate functions for each station in the NOAA CORS Network (NCN)

NGS provides software (M-PAGES / OPUS / OPUS Projects) to differentially position your GPS receiver to each station



Preparation Steps You Can Take

- Everyone's situation is different, so no set of steps is universal.
- NGS has listed 5 such steps on its New Datums page.



Preparation Steps You Can Take

Metadata is essential for efficient file management and transformational certainty.

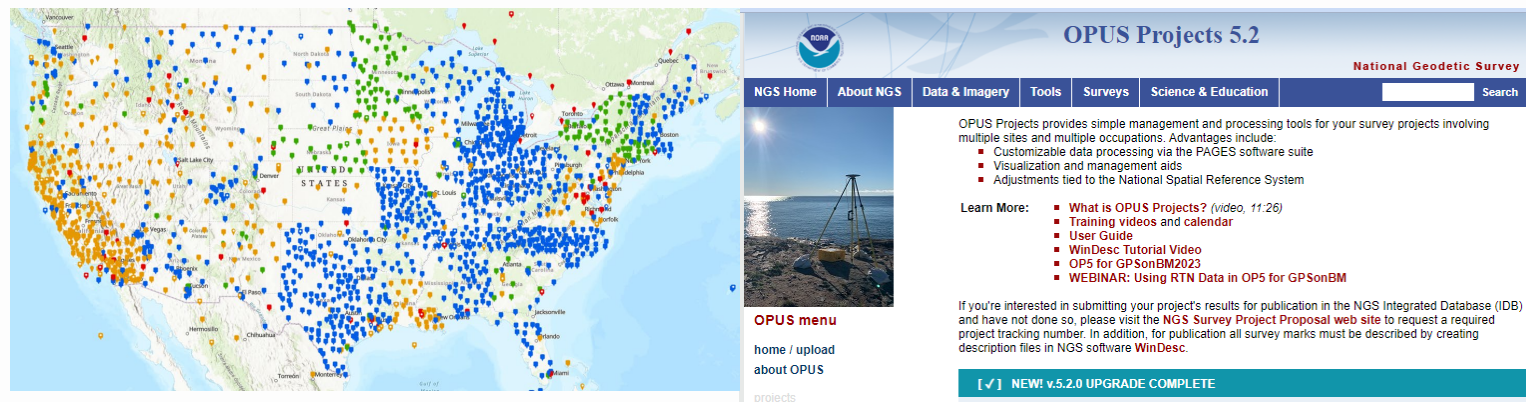
- **Metadata - Require complete metadata** in all surveying and mapping field activities and contracts.
 - **Preserve all original observations.** For GNSS, save your data in ellipsoid heights
 - **Inventory your existing geospatial data and metadata** to enable prioritizing their transformations based on their accuracy requirements
 - Knowing the datums and epochs for your geospatial files will simplify their datum transformations – What version of NAD83?
 - How was data collected and processed? What method used for deriving orthometric heights (NAVD88)? What geoid model was used?
 - Method for deriving water levels and computed tidal datums

3 Ways to Get into the Modernized NSRS

- **Re-survey**
 - Return to the field, and survey points of interest, relying on the modernized NSRS control
 - Definitely can yield new “geodetic control” (for a while) for you to use
- **Re-adjust**
 - Using pre-existing observations, load them up to OPUS, and re-adjust them to modernized NSRS control
 - Probably yields new “geodetic control” (for a while) for you to use
- **Transform**
 - Using tools like NCAT and VDatum (NGS models) estimate mass-changes to your datasets.
 - Does not yield new “geodetic control”

Re-survey or Re-adjust via CORS & OPUS

- The NOAA CORS Network will be improved
- OPUS-S and OPUS-Projects 5.x will be available for GNSS only
 - OPUS 6 (the do-it-all suite) will not be ready until after 2025
- Multiple constellations (M-PAGES)
- Coordinates in ITRF2020, N/M/P/CATRF2022, NAPGD2022, SPCS2022



OPUS Projects 5.2

National Geodetic Survey

NGS Home | About NGS | Data & Imagery | Tools | Surveys | Science & Education | Search

OPUS Projects provides simple management and processing tools for your survey projects involving multiple sites and multiple occupations. Advantages include:

- Customizable data processing via the PAGES software suite
- Visualization and management aids
- Adjustments tied to the National Spatial Reference System

Learn More:

- What is OPUS Projects? (video, 11:26)
- Training videos and calendar
- User Guide
- WinDesc Tutorial Video
- OP5 for GPSONBM2023
- WEBINAR: Using RTN Data in OP5 for GPSONBM

If you're interested in submitting your project's results for publication in the NGS Integrated Database (IDB) and have not done so, please visit the NGS Survey Project Proposal web site to request a required project tracking number. In addition, for publication all survey marks must be described by creating description files in NGS software WinDesc.

[✓] NEW! v.5.2.0 UPGRADE COMPLETE

Transform via NCAT & VDatum

- Using all GNSS and leveling data ever provided to NGS, we will create updates to NADCON and VERTCON, the engines in OPUS and VDatum
- Will get your data to the 2020.00 epoch in the new frames / new geopotential datum
- GPSONBM door to improve transformations closes soon

FedGeoDay Workshop on May 1st

Preparing for the Impending Modernization of the U.S. National Spatial Reference System and Impacts on Federal Geospatial Data Providers and Users

May 1 Workshop - U.S. NSRS Modernization



Free

Sales end on Apr 30, 2024

[This workshop will be held on May 1 beginning at 1:00 at the American Red Cross. Please buy a lunch ticket (sold separately) if you would like lunch ahead of the session. Preparing for the Impending Modernization of the U.S. National Spatial Reference System and Impacts on Federal Geospatial Data Providers

<https://www.fedgeo.us/>

