



# Preparing for the Modernization of the NSRS: NGS Regional Activity

Alaska Geosummit 2023

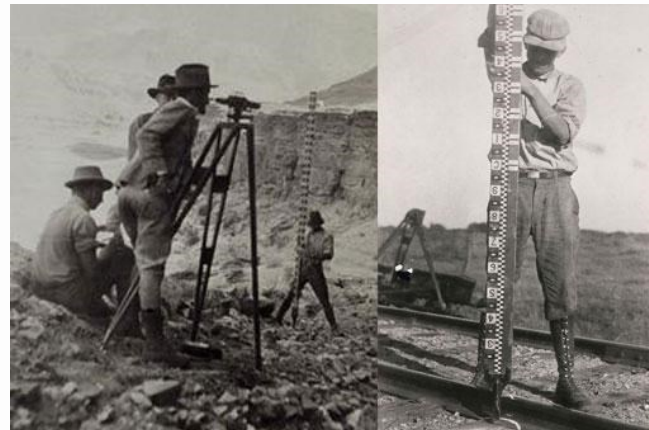
October 25-27, Dena'ina Civic and Convention Center  
Anchorage, AK

*Lynda Bell, Alaska Regional Geodetic Advisor  
NOAA's National Geodetic Survey*



# NOAA and the National Geodetic Survey

Our Nation's First Civilian Science Agency



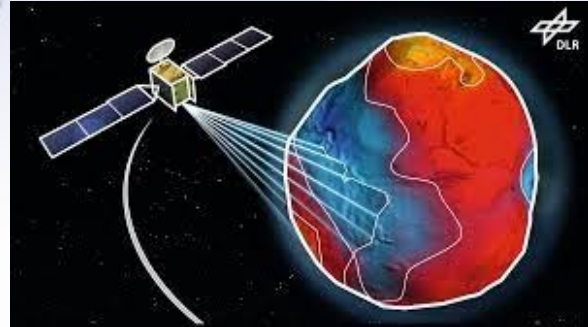
*For more than 200 years, NGS and its predecessor agencies have collaborated with public and private organizations to establish reference stations at precisely determined locations.*







## NGS Sets A Geodetic Standard



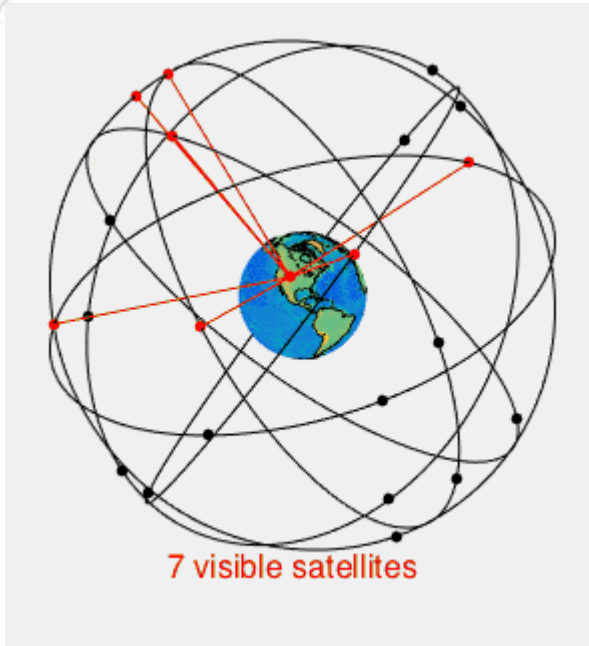
For 200 years, NGS and its predecessor agencies have collaborated with public and private organizations to establish reference stations at precisely determined locations.

More recently, NGS has fostered a network of **continuously operating reference stations (CORS)** where each CORS includes a highly accurate receiver that continuously collects radio signals broadcast by

**Global Navigation Satellite System (GNSS) satellites** forming a network used to accurately position other points of interest.

# High Accuracy GNSS Data Processing at NGS

NGS supports surveyors and others with high-accuracy Global Navigation Satellite System (GNSS) data, ground control marks, models and tools, guidelines and tutorials.



## GNSS Tools

- [Online Positioning User Service \(OPUS\)](#): Tie your GPS observations to U.S. and international frames.
- [Antenna Calibration](#): Look up antenna biases for high-accuracy data processing.
- [Transformation tools \(Geodetic toolkit\)](#): Transform data between reference frames and datums.
- [Geoid Models](#): Convert GPS heights to orthometric (e.g., NAVD 88).
- [Orbits](#): See International GNSS orbit products.

## GNSS Survey Methods

NGS is exploring a proposed new file format, [GNSS Vector Exchange \(GVX\)](#) to more consistently use GNSS vectors in survey networks.



## What is NSRS Modernization?

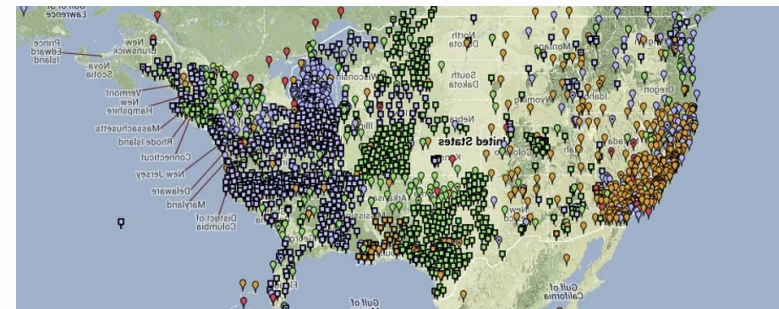
### *Improving the National Spatial Reference System*

The National Geodetic Survey has been working over the last ten plus years to remove inaccuracies in the existing datums of the United States.

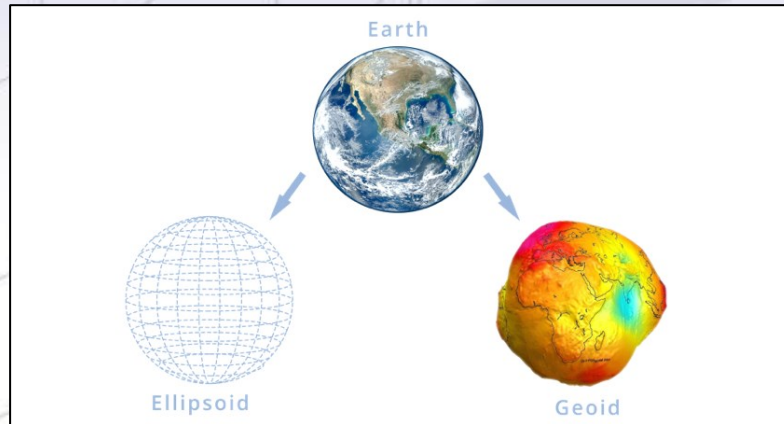
By tracking the dynamic nature of the Earth, and giving users tools to account for it, NGS will provide a new National Spatial Reference System that is semi-dynamic.

**“By fully embracing the benefits of GNSS as the positioning tool of today, and of the future, NGS will effectively link the replacements for NAD 83 and NAVD 88 through a geocentric reference frame and gravimetric geoid model”**

*-Dr. Dru Smith, Chief Geodesist,  
National Geodetic Survey, 2010*



## NSRS : Datums & Reference Frames



*A geodetic datum or reference frame is an abstract coordinate system with a reference surface (such as sea level) that serves to provide known locations to begin surveys and create maps*

**NGS defines official geodetic datums for all federal mapping activities in the U.S. as part of the National Spatial Reference System (NSRS)**



- 1) Vertical Datums**
- 2) Horizontal/Geometric Datums**
- 3) Tidal Datums**





# How You Can Prepare for the Modernization of the National Spatial Reference Frame

National Geodetic Survey Positioning America for the Future geodesy.noaa.gov

**New Datums Are Coming!**

**NOAA is Replacing NAD 83 and NAVD 88.** NOAA's National Geodetic Survey (NGS) will be replacing the datums of the National Spatial Reference System (NSRS), including the **North American Datum of 1983 (NAD 83)** and the **North American Vertical Datum of 1988 (NAVD 88)**. NGS will provide the tools to easily transform between the new and old datums. Read the NGS Ten-Year Plan and visit the **New Datums Web page** on our site to learn more.

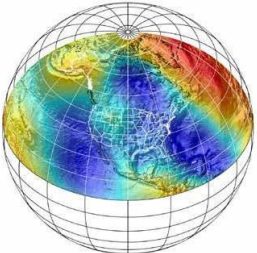
**Benefits**  
The new reference frames (geometric and geopotential) will rely primarily on **Global Navigation Satellite Systems (GNSS)**, such as the **Global Positioning System (GPS)**, as well as on a **gravimetric geoid model** resulting from NGS' **Gravity for the Redefinition of the American Vertical Datum (GRAV-D)** Project.

The target accuracy of differential orthometric heights (heights relative to sea level) in the geopotential reference frame will be 2 centimeters over any distance, where possible.

**What You Can Expect**  
The magnitude of change with the new datums will vary depending on the datum you are using and your geographic location. The new geometric datum will change latitude, longitude, and ellipsoid height between 1 and 4 meters. In the conterminous United States (CONUS), the new vertical datum will change heights on average 50 centimeters, with approximately a 1-meter tilt towards the Pacific Northwest.

**How You Can Prepare**

- Learn if **legislation** or other formal documents referencing NAD 83 and NAVD 88 need to be changed in your state.
- **Transform existing data** to the latest NSRS datums and realizations; i.e. NAD 83 (2011), GEOID18, and NAVD 88.
- **Obtain precise ellipsoidal heights** on NAVD 88 bench marks, and visit the GPS on Bench Marks **Web page** to learn more.
- **Require and provide complete metadata** on all mapping contracts. See our website for more details.



*The new datums will extend across CONUS and US territories. The terrestrial reference frames replacing NAD 83 will be consistent with geocentric global reference frames defining latitude and longitude. The geopotential datum replacing NAVD 88 will be based on a gravimetric geoid model, enhanced by data from NGS' Gravity for the Redefinition of the American Vertical Datum (GRAV-D) Project.*

**New Datums**

National Oceanic and Atmospheric Administration • National Geodetic Survey

1. Transform your coordinates using NGS Coordinate and Transformation Tool (NCAT)
2. Record your metadata by knowing the datums and epochs of your geospatial files
3. Perform GPS on Benchmarks Operations.
4. Review State Plane Coordinate System requirements and prepare to update legislation, as needed





## The NGS Regional Geodetic Advisor Program

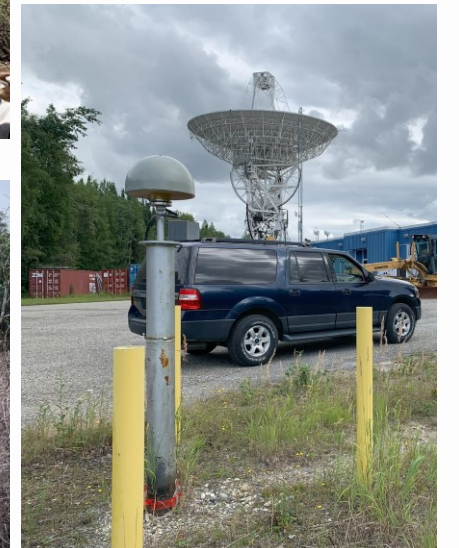


The Regional Geodetic Advisor is a federal employee of NOAA's National Geodetic Survey serving as a liaison between NGS and its public, academic, and private sector constituents who are managing the geodetic component of geospatial activities tied to the National Spatial Reference System (NSRS) in their region. NGS's Regional Advisor Program is an integral part of supporting and preparing for Modernization of the NSRS in each of their regions across the U.S.



## NSRS Modernization : Regional Preparation

- ✓ New **CORS** Installations
- ✓ **Braced Monument Workshops**
- ✓ CORS Station Improvements
- ✓ **GPS on Benchmarks**
- ✓ **OPUS** Training
- ✓ **Vertical Control** Improvements
- ✓ Geodetic Control **Densification**
- ✓ **Partnership Work**
- ✓ **Foundation CORS**







## Enhancing and Densification of Geodetic Survey Control through Partnerships

**Positioning** – improvements in both vertical and horizontal positioning

**Ground truthing** – improve base station positions for LIDAR, aerial, drone, photogrammetric, altimetric data

**Datum consistency** -throughout multiple data sets used for digital elevation modeling







## NGS in Alaska 2023: GRAV-D

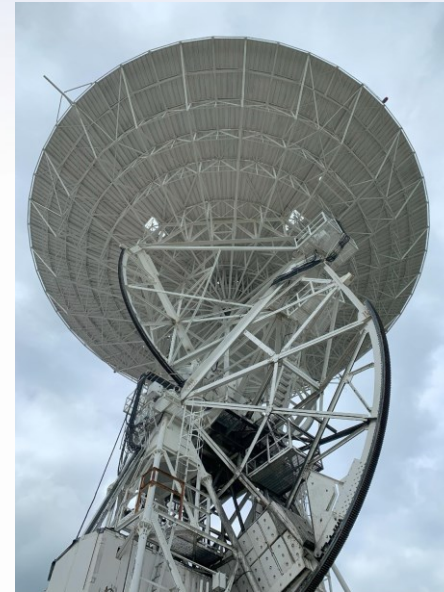
The NGS GRAV-D (Gravity for the Redefinition of the American Vertical Datum) aerial surveys were completed this year in Alaska with the final set of flights flown through the summer of 2023, bringing this 15-year project to successful completion. This data will be a critical component in the development of the North American-Pacific Geopotential Datum of 2022 (NAPGD2022).





## NGS in Alaska 2023: Foundation CORS

Foundation CORS sites at the NOAA/NESDIS Gilmore Creek Facility and the Cold Bay NASA DORIS site in Fairbanks and Cold Bay, AK have been identified for reconnaissance and future construction. These braced monument GNSS FCORS stations and inSAR Reflectors will be installed in 2024 in support of Foundation CORS site development in crucial areas of Alaska.







## NGS in Alaska 2023: VDATUM

NGS completed foundational GNSS data observations this summer along targeted tidal benchmarks in the Cook Inlet, the Kenai Peninsula, and within Kenai Fjords National Park in support of NGS's Vertical Datum Transformation Tool.

This was an excellent start in filling coastal VDATUM observation gaps along the coast in southern Alaska, with more work planned for FY24 in the Gulf of Alaska. NGS worked with partners from the U.S. Coast Guard and the National Park Service to obtain these important gap filling measurements along southern Alaska's rugged coastline.







As always, we want to thank you for supporting the NSRS and encourage you to reach out to us so we can support *YOU* in preparing for Modernization!  
<https://geodesy.noaa.gov>





**Lynda Bell**  
**NOAA/NGS ALASKA REGIONAL**  
**GEODETIC ADVISOR**

**[lynda.bell@noaa.gov](mailto:lynda.bell@noaa.gov)**  
**240-988-5919**

### **About**

I am currently a permanent civil servant for the Department of Commerce, serving as the Alaska Regional Geodetic Advisor for NOAA's National Geodetic Survey (NGS). I am serving as a liaison between NGS and its public, academic, and private sector customers within my region, providing guidance and assistance on geospatial activities that are tied to the National Spatial Reference System. My current duty station is located within the NOAA NWS suite in the James Fitzgerald Federal Building in Anchorage, AK.

I have also had the great privilege to serve several other federal agencies in the geospatial community, working as a Geophysicist and Senior Scientist at NASA's Goddard Space Flight Center in Greenbelt, MD and as a Sea Level Specialist at the National Park Service Headquarters in Fort Collins, CO.