



Preparing for National Spatial Reference System Modernization

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National Geodetic Survey

Agenda

- Basics
 - Planned Changes
 - Significance
 - Motivations
 - Activities
- [GPS on BM Campaign](https://geodesy.noaa.gov/datums/newdatums/)
- Customer Tools
 - [OPUS](#)
 - [NCAT](#)

<https://geodesy.noaa.gov/datums/newdatums/>

The screenshot shows the NOAA National Geodetic Survey website. The header includes the NOAA logo and the text 'National Geodetic Survey Positioning America for the Future'. A navigation menu contains links for 'NGS Home', 'About NGS', 'Data & Imagery', 'Tools', 'Surveys', and 'Science & Education', along with a search bar. The main content area is titled 'New Datums' and features a 'Delayed Release Message' box with the text 'Preview the Modernized NSRS on the NGS Alpha Web Site!'. Below this, a paragraph explains that NGS will replace three North American Datum of 1983 (NAD 83) frames and all vertical datums, including the North American Vertical Datum of 1988 (NAVD 88), with four new terrestrial reference frames and a geopotential datum. It also states that the new reference frames 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 the Gravity for the Redefinition of the American Vertical Datum (GRAVD) Project. A second paragraph notes that these new reference frames will be easier to access and to maintain than the current NSRS, which relies on physical survey marks that deteriorate over time. A 'Subscribe for email notifications' button is visible. The 'Events' section lists 'FIG Working Week 2023 Industry Engagement' and several summits from 2010 to 2021. A grid of buttons provides quick access to various resources: 'Delayed Release Message', 'Background', 'What to Expect', 'Get Prepared', 'Blueprint Documents', 'Track our Progress', 'Naming Convention', 'FAQs', 'Watch Videos', and 'Related Projects'. The footer contains links for 'NOS Home', 'NGS Employees', 'Privacy Policy', 'Feedback', 'Disclaimer', 'USA.gov', 'Ready.gov', 'Site Map', and 'Contact Webmaster'.

The National Geodetic Survey

Mission and Strategic Plan

Mission:

To define, maintain and provide access to the National Spatial Reference System to meet our nation's economic, social, and environmental needs.

Vision:

Everyone accurately knows where they are and where other things are at all times and in all places!

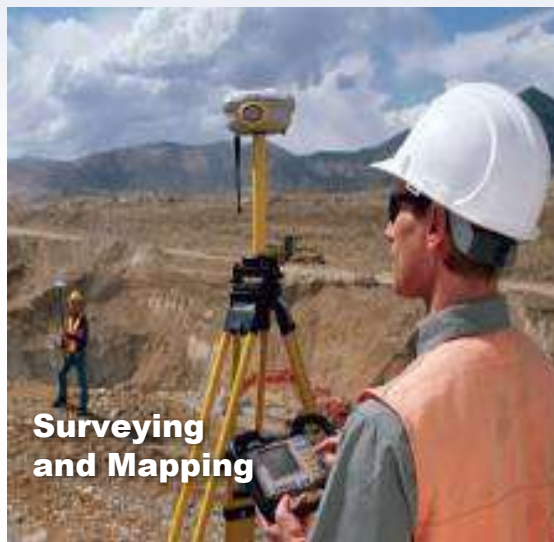
Organizational Structure

- Department: **U.S. Department of Commerce**
- Agency: **National Oceanic and Atmospheric Administration (NOAA)**
- NOAA Line Office: **National Ocean Service (NOS)**
- **NGS Leadership and Organization Chart**

<https://geodesy.noaa.gov/>

NGS Provides the Geodetic Infrastructure Critical to Our Geospatial Economy through the NSRS

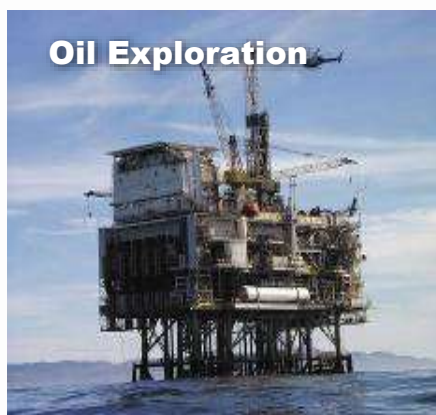
The "P" in PNT



Satellite Operations



Personal Navigation



Survey Marks

Accurate maps begin with accurate coordinates!

Geodetic control (NSRS) is the foundation layer for all geospatial products.

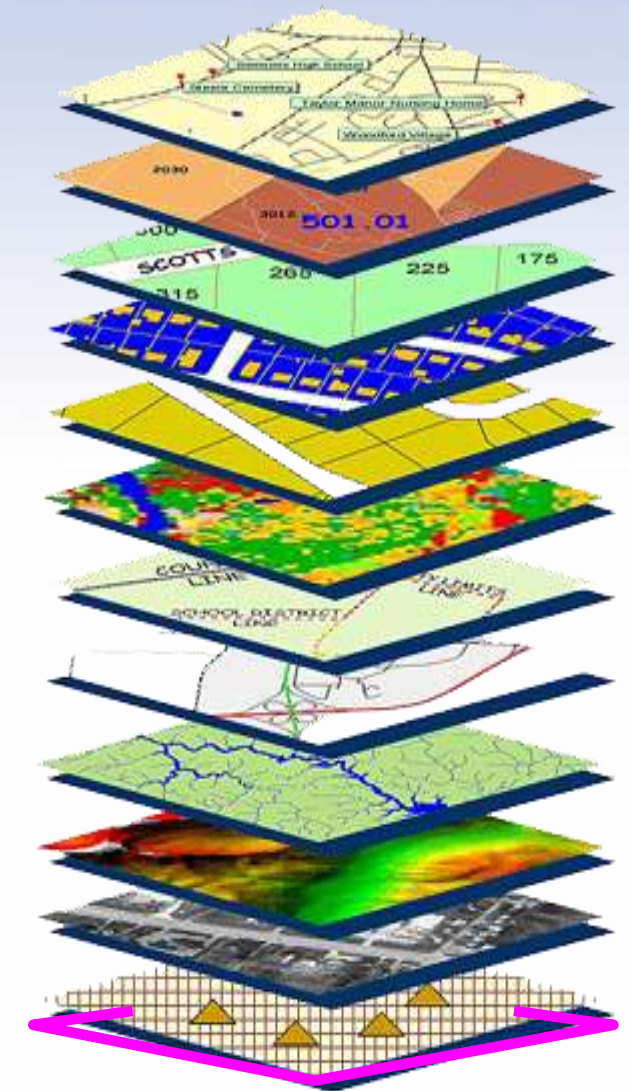
Easiest way to think of “geodetic control”:

Points with Coordinates

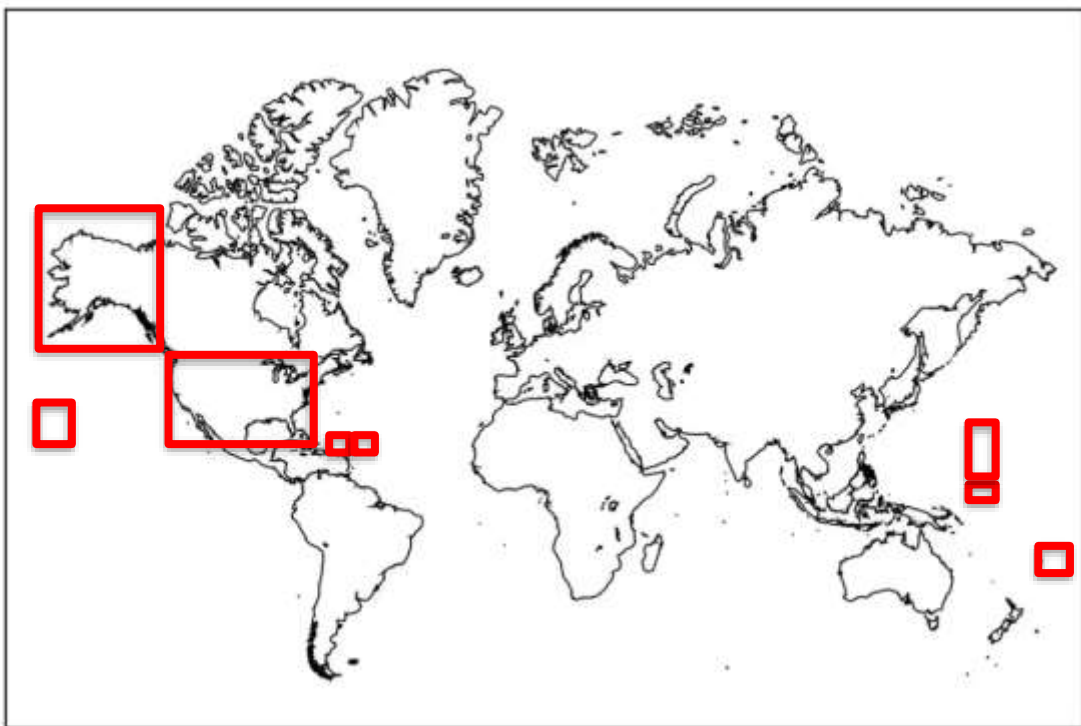
****Soon to be Coordinates as a function of time*

Without a geodetic control “base map” layer, GIS applications will not align properly!

Geodetic control needs to be more accurate than any survey or map which builds upon it



Extent of the current NSRS



Frames: Truly global but used regionally
Geoid/Vertical: Regional

Conterminous US (CONUS; “Lower 48”)

Alaska

Hawaii

Territories: Puerto Rico, U.S. Virgin Islands, American Samoa, Guam, CNMI

Planned Changes: Replacing NAD 83

The Old:

NAD 83(2011)

NAD 83(PA11)

NAD 83(MA11)

The New:

The North American Terrestrial Reference Frame of 2022
(NATRF2022)

The Caribbean Terrestrial Reference Frame of 2022
(CATRF2022)

The Pacific Terrestrial Reference Frame of 2022
(PATRF2022)

The Mariana Terrestrial Reference Frame of 2022
(MATRF2022)

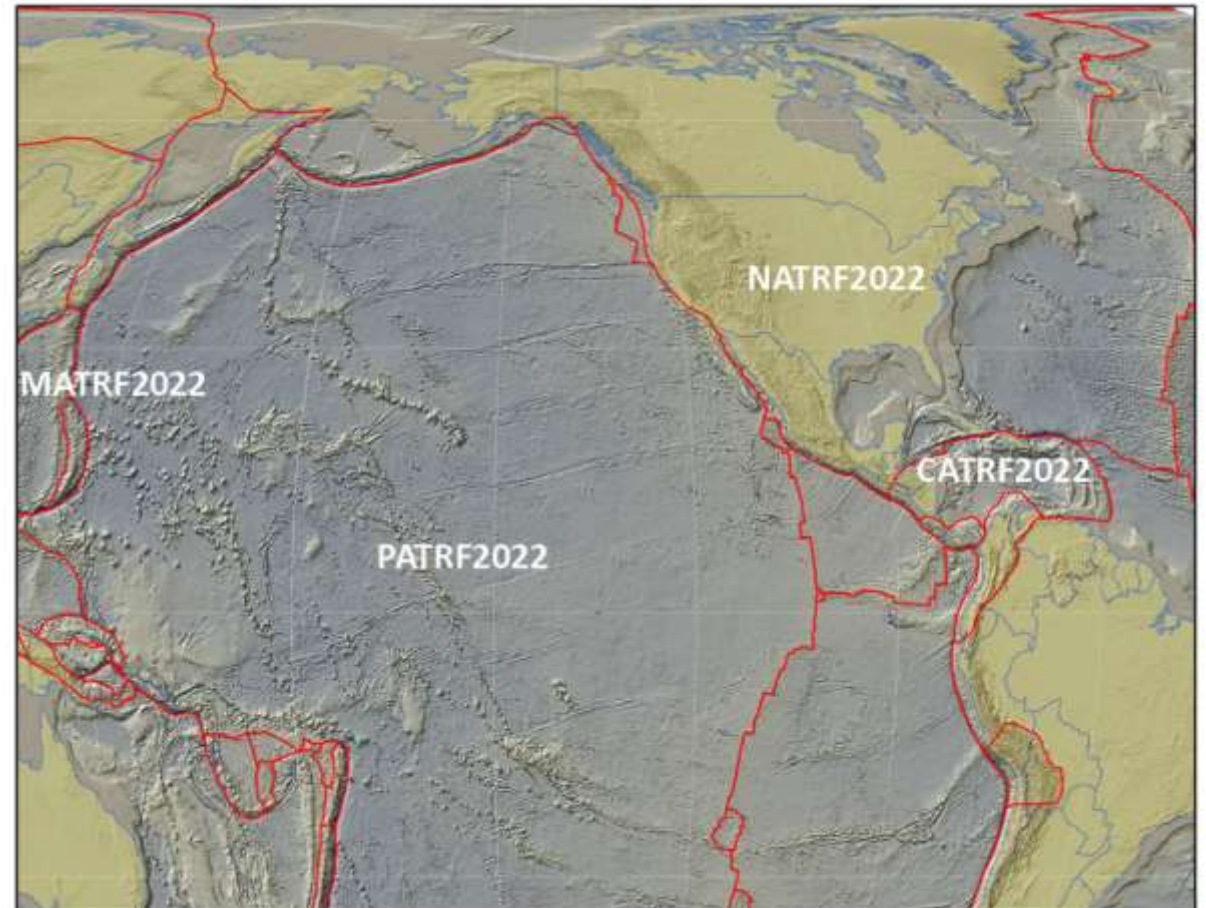
The Future Reference Frames

Will be based on a densified ITRF model (e.g. SIRGAS)

Tectonic Plate based

Each Plate is based on the same densified ITRF model

North America	NATRF
Caribbean	CATRF
Pacific	PATRF
Mariana	MATRF



Planned Changes: Replacing NAVD 88

Orthometric Heights

Normal Orthometric Heights

Dynamic Heights

Gravity

Geoid Undulations

Deflections of the Vertical

The Old:

NAVD 88

PRVD 02

VIVD09

ASVD02

NMVD03

GUVD04

IGLD 85

IGSN71

GEOID18

DEFLEC18

The New:

The North American-Pacific **Geopotential Datum** of 2022 (NAPGD2022)

Will include:

- GEOID2022
- DEFLEC2022
- GRAV2022
- DEM2022
- More

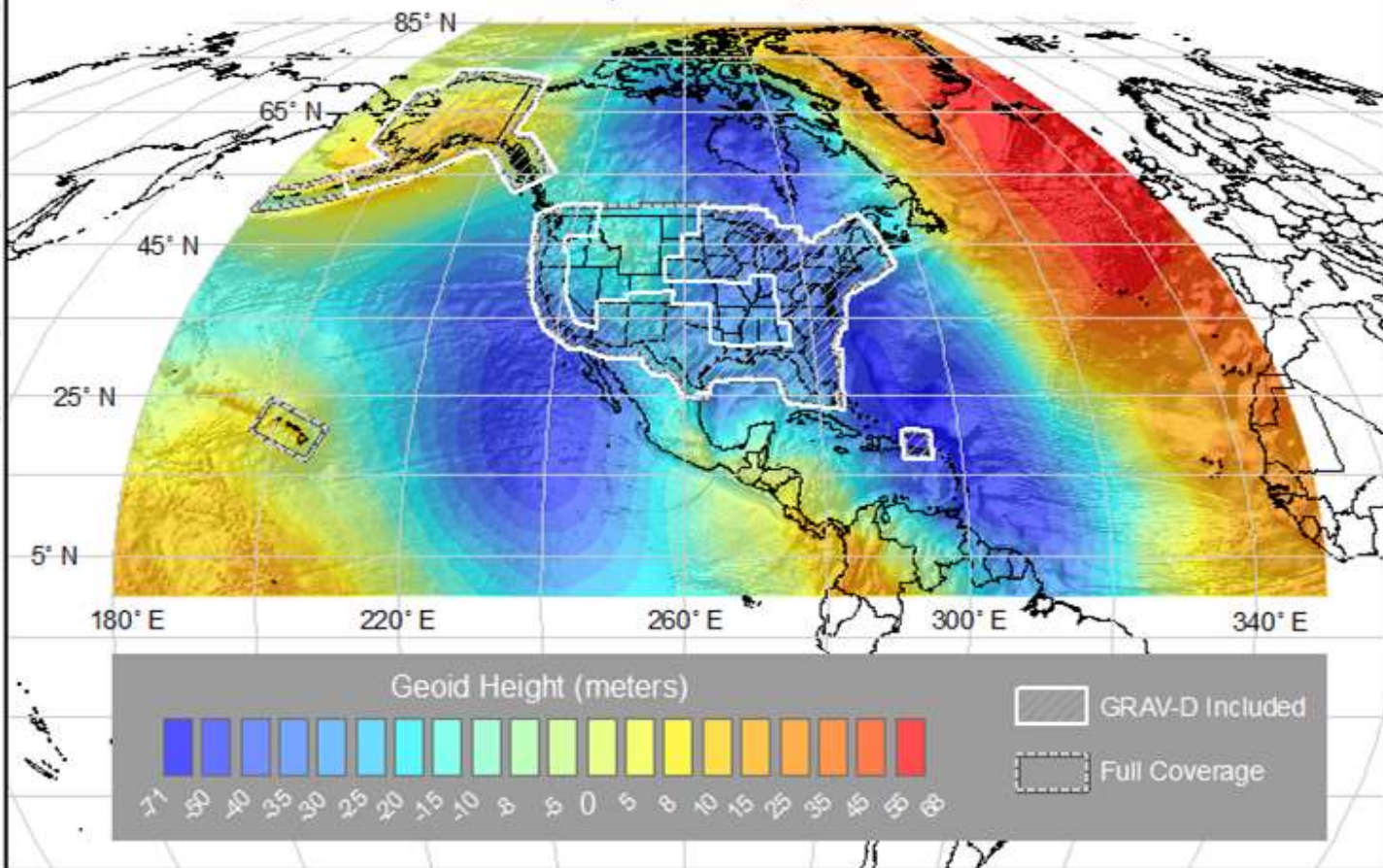
A HUGE component of this effort is GRAV-D:

Gravity for the Redefinition of the American Vertical Datum

NAPGD2022 Geopotential Datum

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

NGS, Canada, and Mexico released the first-ever joint geoid model



1/4 Earth's Surface

Models included:
Geopotential, Geoid
Deflection of Vertical,
& Gravity



Guam/CNMI



American Samoa

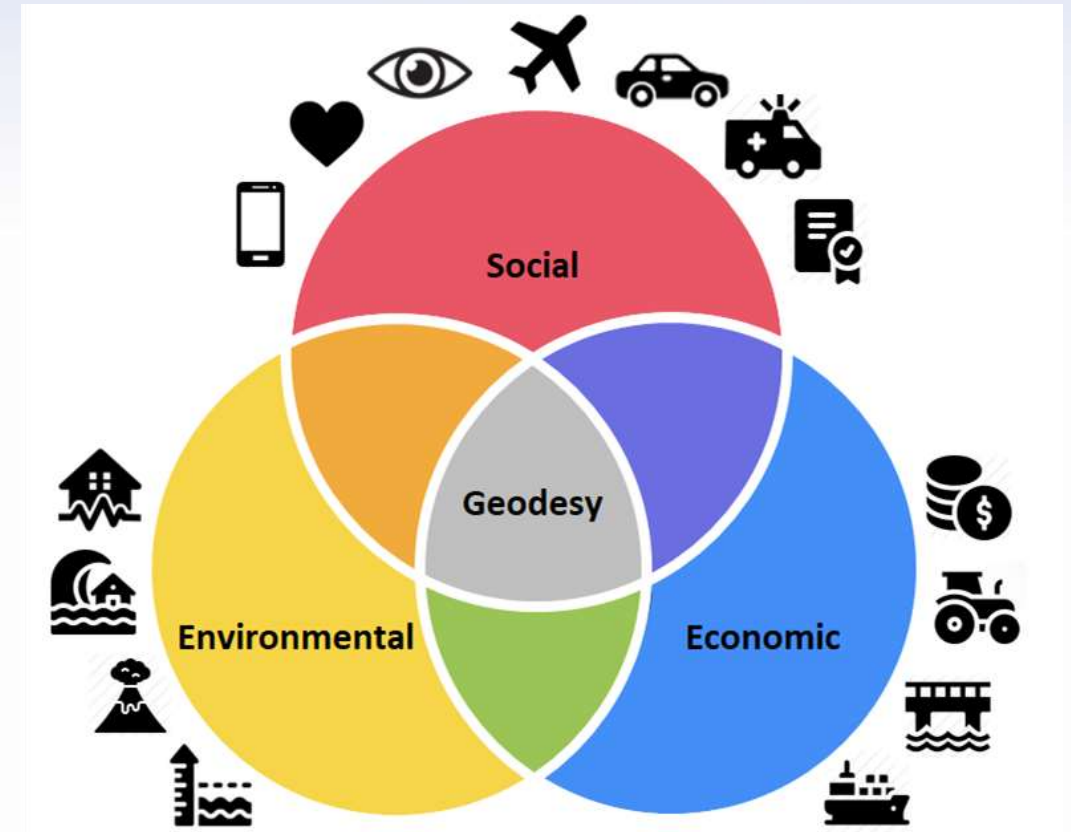
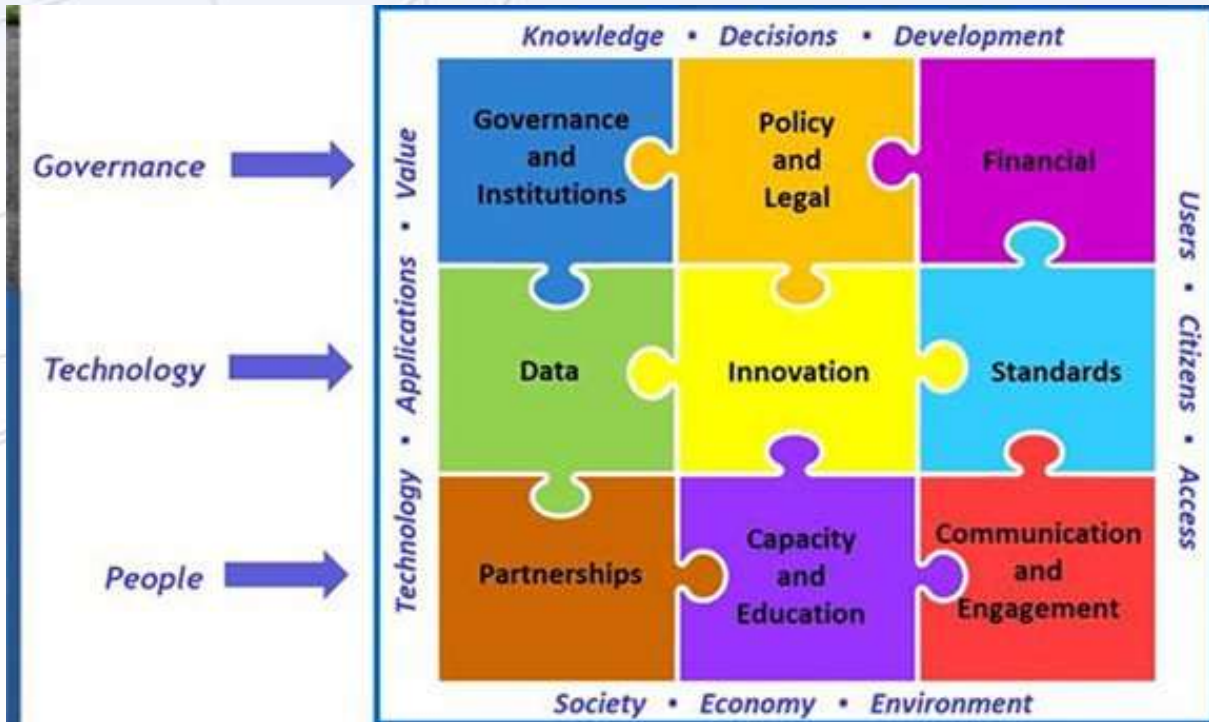
Significance to Users

- Global models accurate and precise at local scales
 - Datum shifts create meter-level changes (more in GPSONBM section)
 - Will tie NSRS to ITRS directly
 - Will more closely relate to current realizations of WGS-84
 - Minimizes impacts to navigation
- Better geospatial products for improved results in government, business and research

International Motivations: UN-GGIM

Integrated Geospatial information Framework

Geodetic Component of Geospatial Data



Focus is on building capacity in governments but also the broader geospatial sector to build the NSDI

National Motivations: the GDA and FGDC

- Geospatial Data Act
 - Many aspects of IGIF
 - Standards, etc.
 - Empowered FGDC
 - NGDA's and other data
- Governance piece
 - only US Agencies are covered by it
- This GeoGov Summit broadens the reach
 - Private sector, State, local, tribal & academia

FGDC.GOV
FEDERAL GEOGRAPHIC DATA COMMITTEE

HOME **WHO WE ARE** WHAT WE DO INITIATIVES ORGANIZATION RESOURCES

GEOSPATIAL DATA ACT OF 2018

Home / Geospatial Data Act 2018

The Geospatial Data Act of 2018 (GDA) was signed into law by the President on October 5, 2018. The GDA was included as a component of the FAA Reauthorization Act (H.R. 302, P.L. 115-254). The GDA is now in *U.S. Code, Title 43 – Public Lands, Chapter 46: GEOSPATIAL DATA*. See the section cross-reference table below for a quick section mapping between the H.R. and U.S.C. versions. Note that documents provided here prior to September 2020 contained the HR section references. Resources, updates, and information about the GDA will be posted on this page as we work with partners to implement the Act.

- [Geospatial Data Act of 2018 - U.S. Code \(pdf\)](#)
- [Geospatial Data Act of 2018 - H.R. 302 Final Text \(pdf\)](#)
- [Geospatial Data Act of 2018 - H.R. 302 Final Text Web/Online Version](#)
- [GDA Section-by-Section Summary \(pdf\)](#)

Resources

- [GDA Plans](#)
- [GDA Reports](#)
- [GDA Fact Sheet - May 2019 \(pdf\)](#)
- [FGDC Statement on Passage of the Geospatial Data Act of 2018](#)
- [Congressional Research Service Report on the Geospatial Data Act of 2018 \(pdf\)](#)
- [GDA Tiger Team](#)
- [NSDI Strategic Plan](#)

Section cross-walk between H.R. and U.S.C. versions of GDA

43 USC Ch. 46	Section Title	H.R. 302, PL. 115-254
2801	Short Title; Findings	751
2801	Definitions	752
2802	Federal Geographic Data Committee	753
2803	National Geospatial Advisory Committee	754
2804	National Spatial Data Infrastructure	755
2805	National Geospatial Data Asset Data Themes	756
2806	Geospatial Data Standards	757
2807	GeoPlatform	758
2808	Covered Agency Responsibilities	759

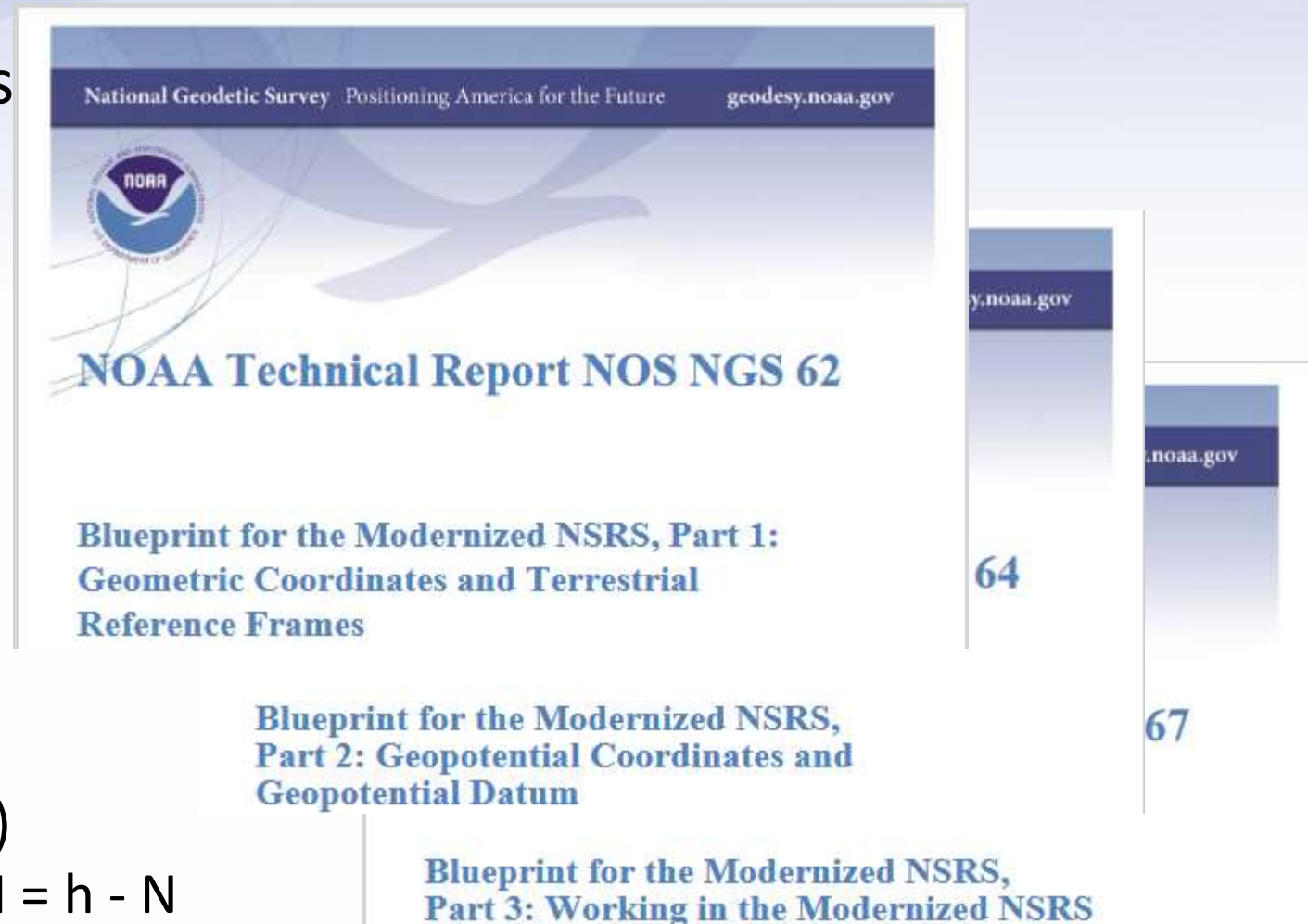
Geoplatform.gov

- Making U.S. Government data more F.A.I.R.
 - Findable, Accessible, Interoperable and Reusable
- Interoperable includes metadata
 - Includes coordinate reference systems
 - such as the NSRS
- Data harvested from NOAA through data.gov to geoplatform.gov
- However, it is also on our website



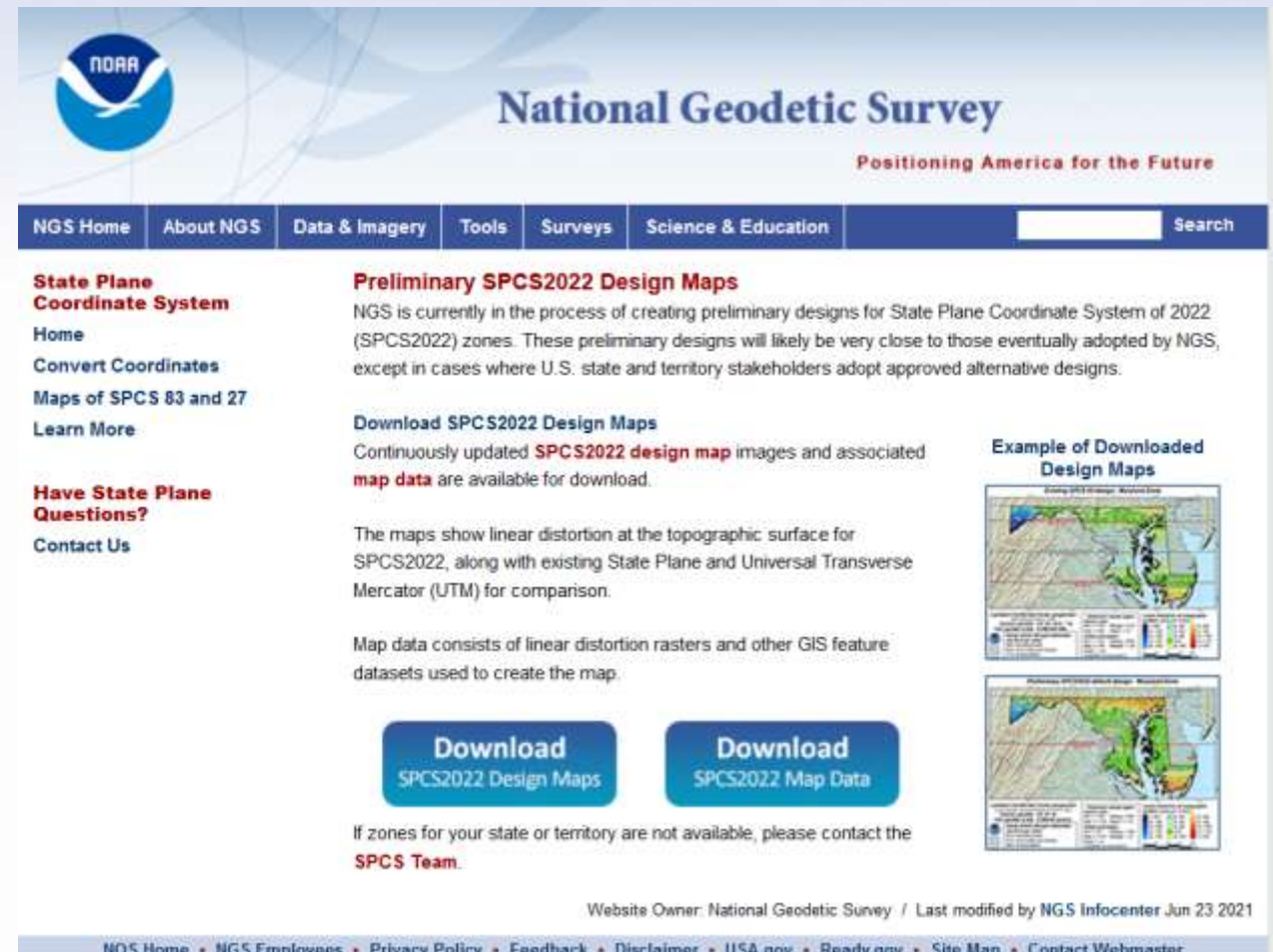
How: NSRS Modernization Blueprints

- Part 1 - Geometric and TRF's
 - EPP - TRF's tied to ITRF2020
 - IFDM - deformation in TRF
- Part 2- Geopotential
 - Vertical Datum
 - Gravity
 - DoV's
- Part 3 - User Access
 - GNSS observations by user
 - NOAA CORS Network
 - OPUS processing (more later)
 - GNSS obs to get to vertical: $H = h - N$



What – Modernizing the NSRS

- Defining new TRF parameters
- [GRAV-D](#) for NAPGD2022
- [State Plane Coordinate Systems](#)
- Continued Data collection
 - [GPS on BM](#) (next section)
- Geospatial data tools
 - [OPUS](#) and OPUS Projects ([OP](#))
 - NGS Coordinate Conversion and Transformation Tool ([NCAT](#))

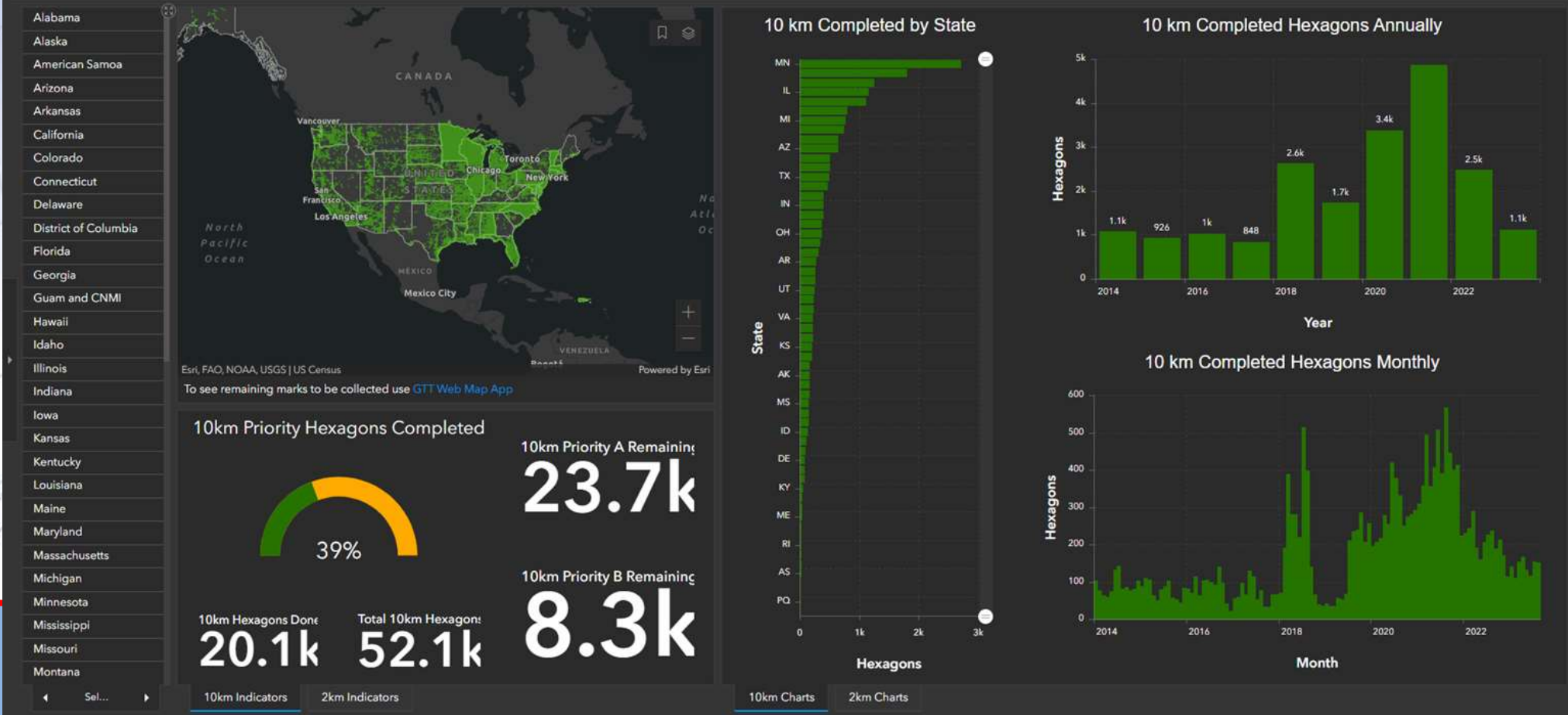


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- State Plane Coordinate System**: Includes links for 'Home', 'Convert Coordinates', 'Maps of SPCS 83 and 27', and 'Learn More'.
- Have State Plane Questions? Contact Us**: A link for user inquiries.
- Preliminary SPCS2022 Design Maps**: A section explaining that NGS is creating preliminary designs for the State Plane Coordinate System of 2022 (SPCS2022) zones. It notes that these designs will likely be very close to those eventually adopted by NGS, except in cases where U.S. state and territory stakeholders adopt approved alternative designs.
- Download SPCS2022 Design Maps**: A section stating that continuously updated SPCS2022 design map images and associated map data are available for download. It explains that the maps show linear distortion at the topographic surface for SPCS2022, along with existing State Plane and Universal Transverse Mercator (UTM) for comparison. It also notes that map data consists of linear distortion rasters and other GIS feature datasets used to create the map. Two 'Download' buttons are provided: 'Download SPCS2022 Design Maps' and 'Download SPCS2022 Map Data'.
- Example of Downloaded Design Maps**: Two small map thumbnails are shown, illustrating the design maps and map data.

At the bottom of the page, there is a footer with the text: 'Website Owner: National Geodetic Survey / Last modified by NGS Infocenter Jun 23 2021' and a navigation bar with links for 'NGS Home', 'NGS Employees', 'Privacy Policy', 'Feedback', 'Disclaimer', 'USA.gov', 'Ready.gov', 'Site Map', and 'Contact Webmaster'.

GPS on Bench Marks for the Transformation Tool Progress Dashboard NOAA's National Geodetic Survey



BT

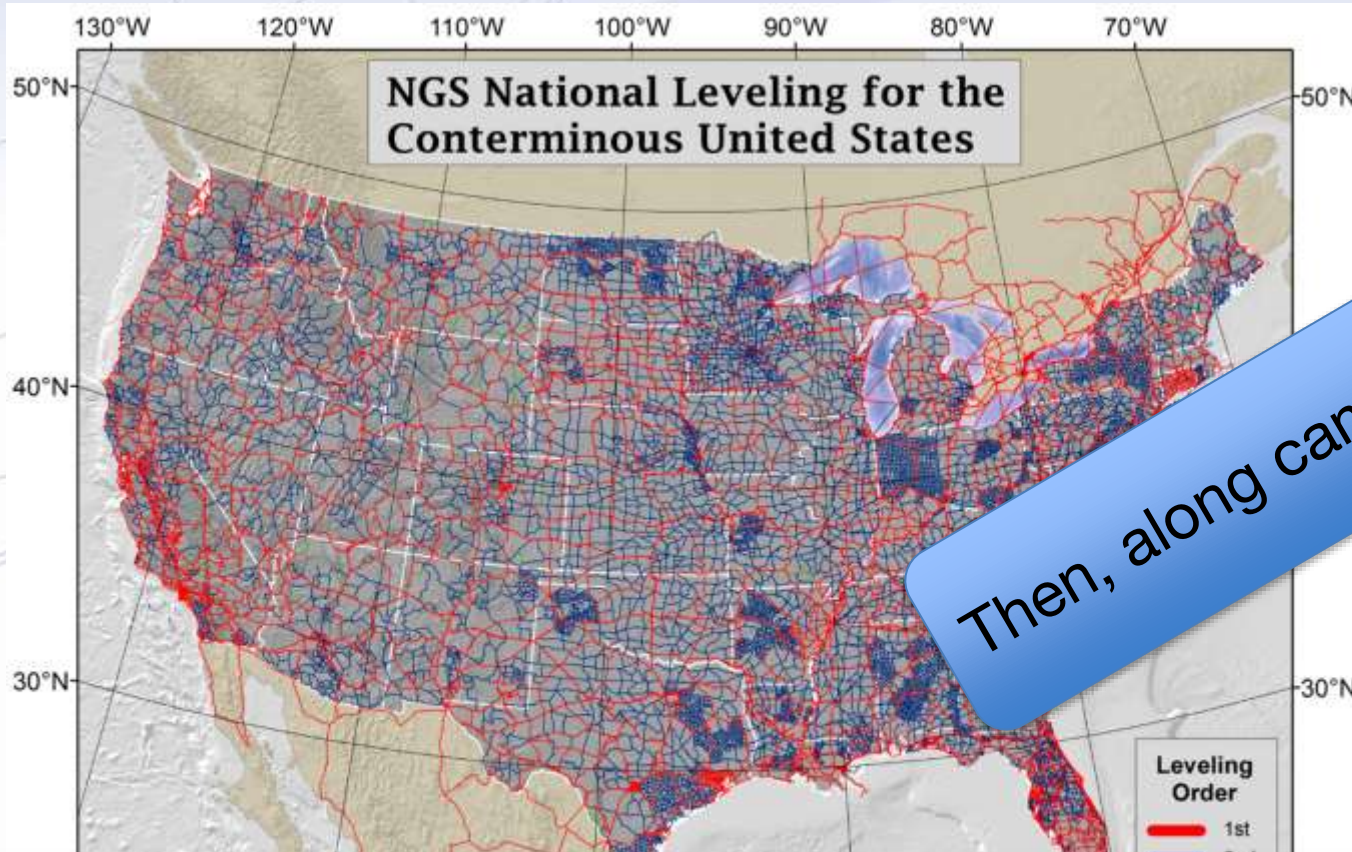
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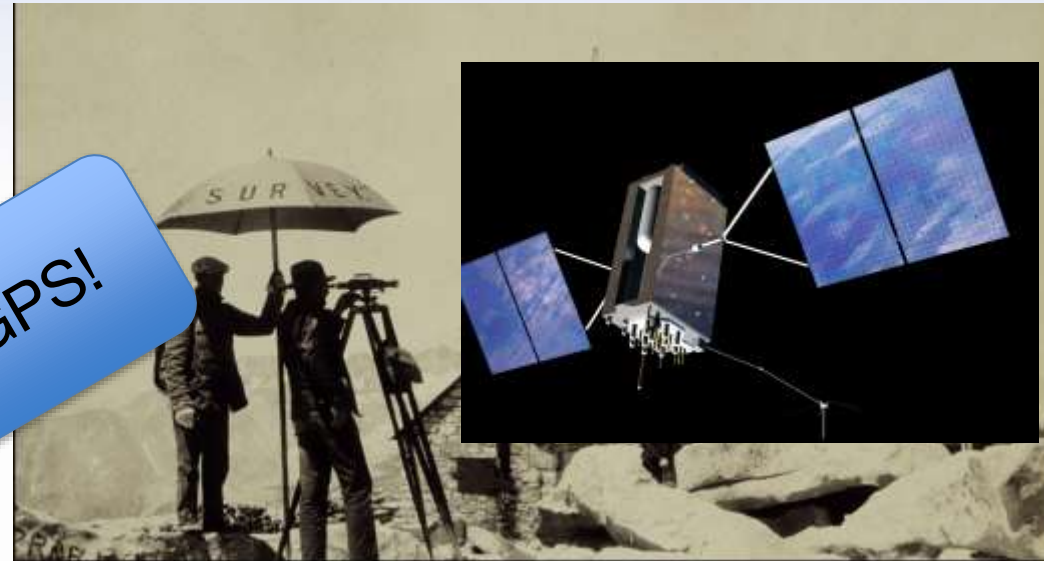
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First, a little history - NAVD 88 was released in 1991, created using decades of Continental-Scale Geodetic Leveling



Then, along came GPS!



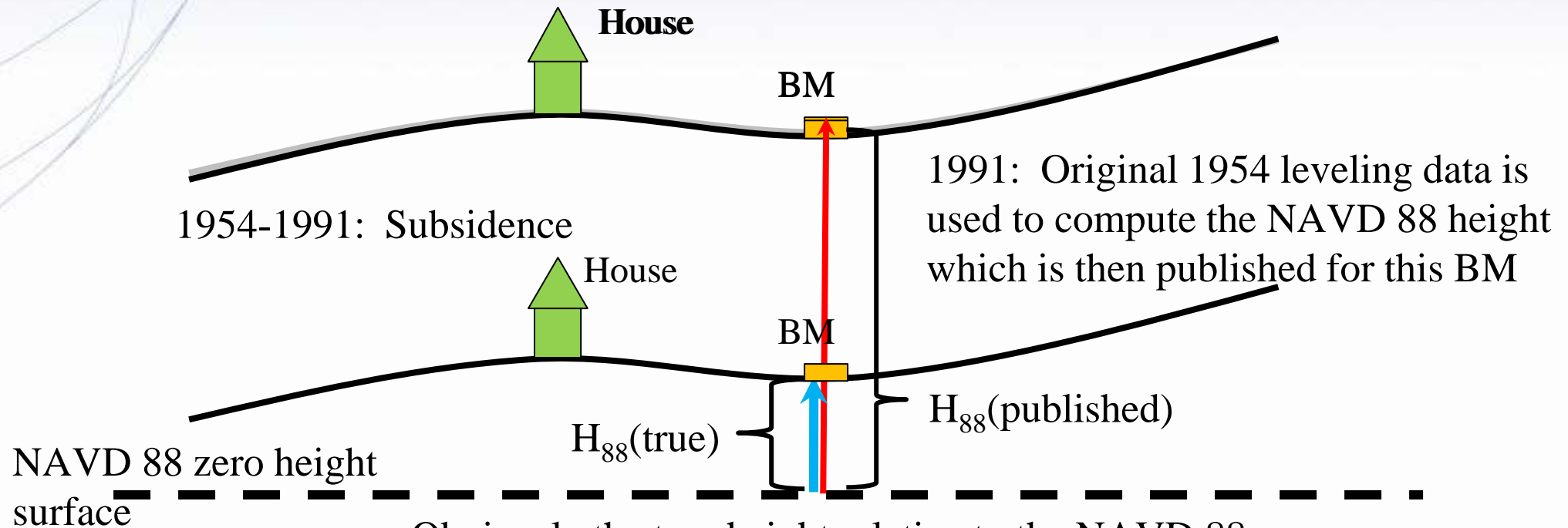
NAVD 88 consists of about 800,000 bench marks connected by about 2.2M km of leveling over 80 years

NAVD 88 Issues

NAVD 88 suffers from *unknown movements* before, during and after its original adjustment

By way of example...

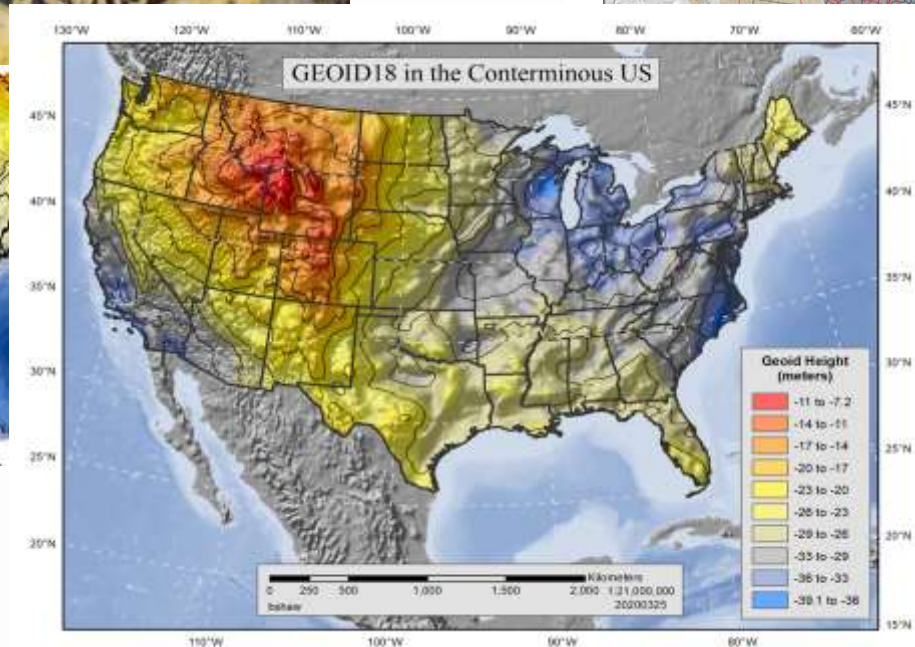
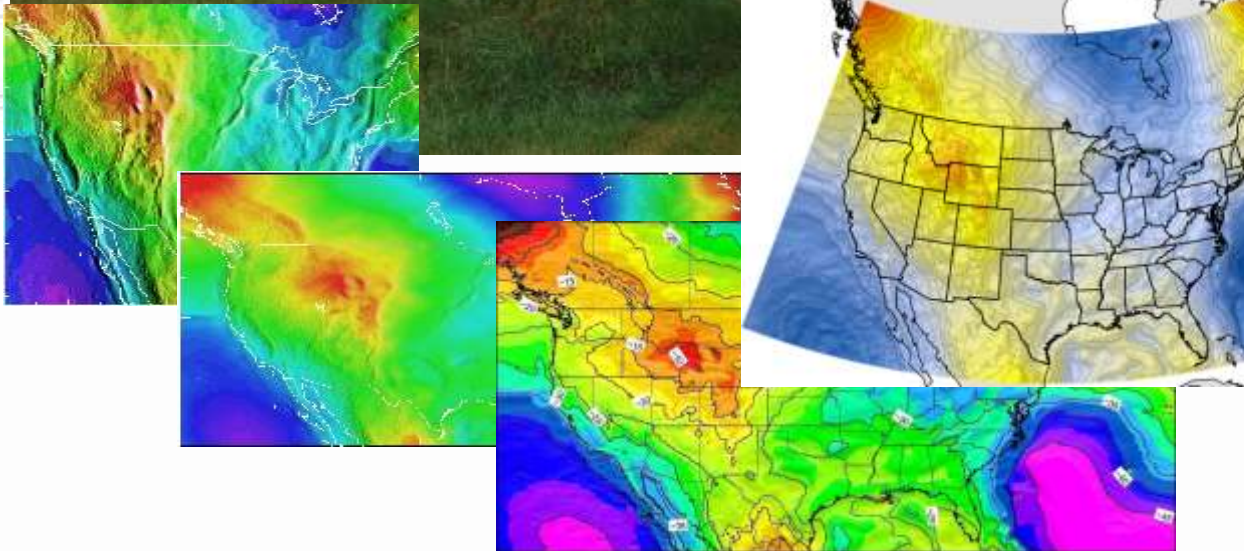
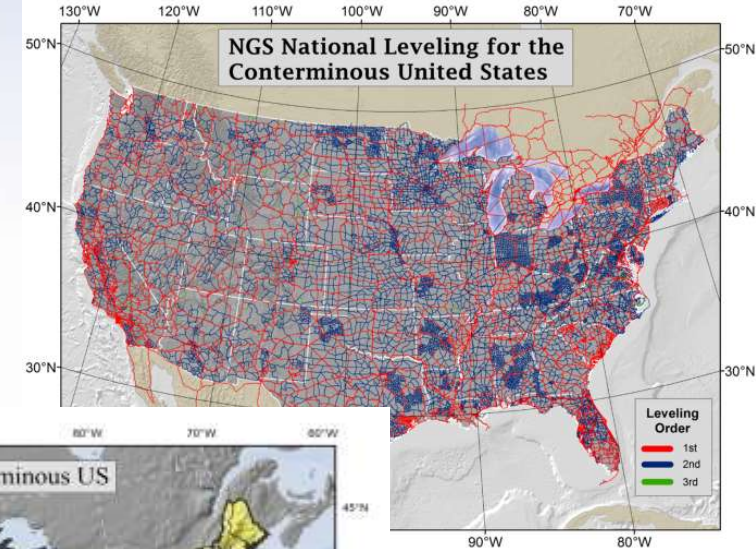
1954: Leveling Performed to bench mark



1991: Original 1954 leveling data is used to compute the NAVD 88 height which is then published for this BM

Obviously the true height relative to the NAVD 88 zero surface is not the published NAVD 88 height

Starting in the late 1990's, NGS created a series of hybrid geoid models by using GPS observations on NAVD88 marks, providing users a way to produce GPS derived NAVD88 heights.



The GPSONBM crowd sourced data collection effort provided nearly 7,000 new data points for use in GEOID18

GPS on Bench Marks - What & Why?

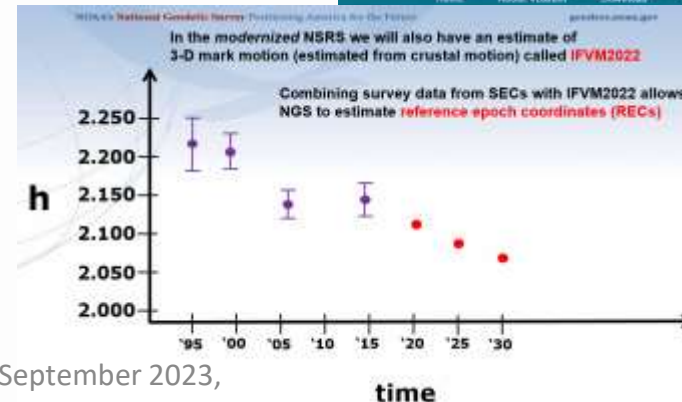
GPS on Bench Marks is about preparing the country and our communities to take full advantage of the benefits of the Modernized NSRS, by collecting new GPS observations on bench marks with published NAVD 88 heights.

Primary GPSONBM Campaign Benefits:

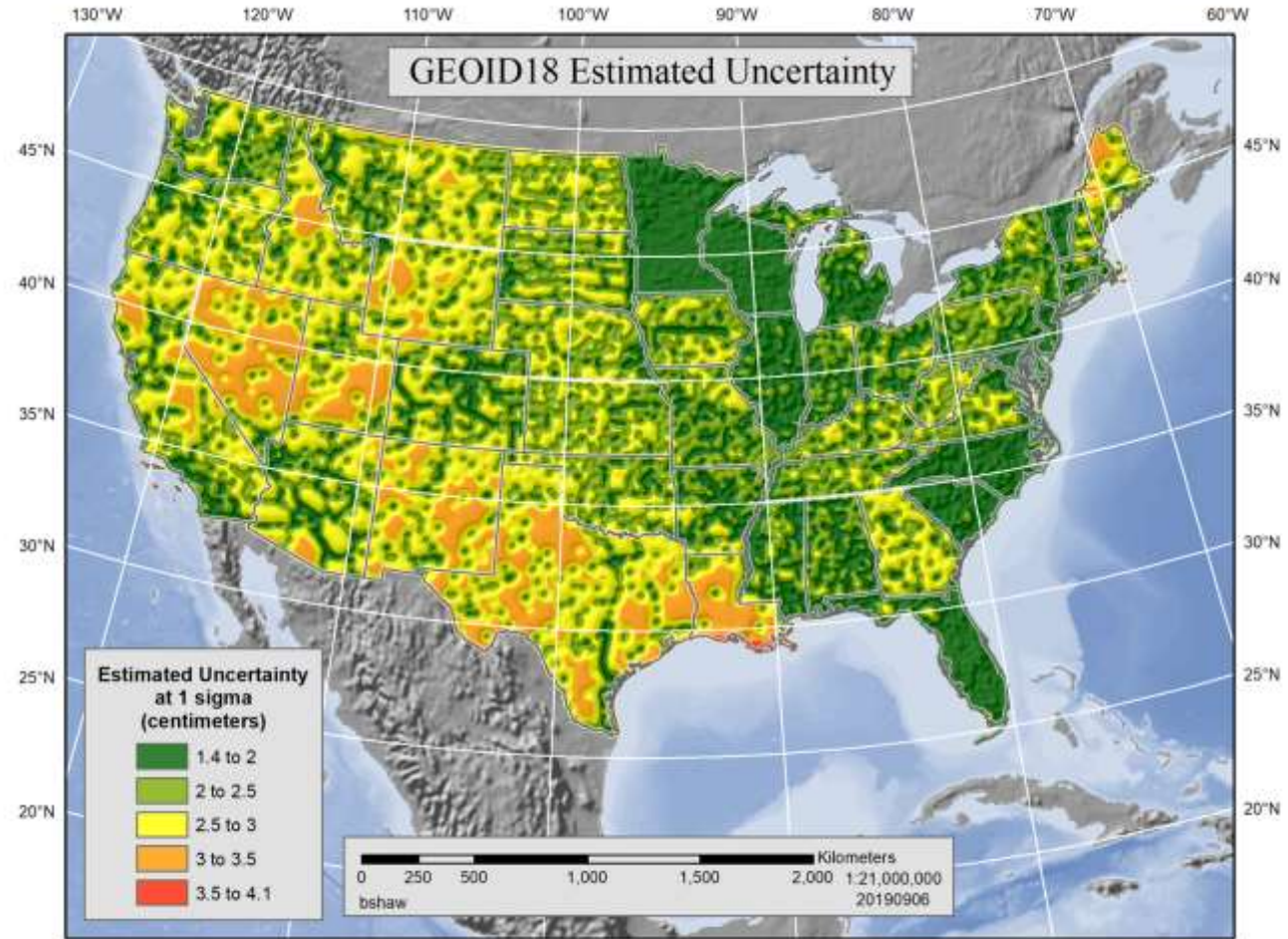
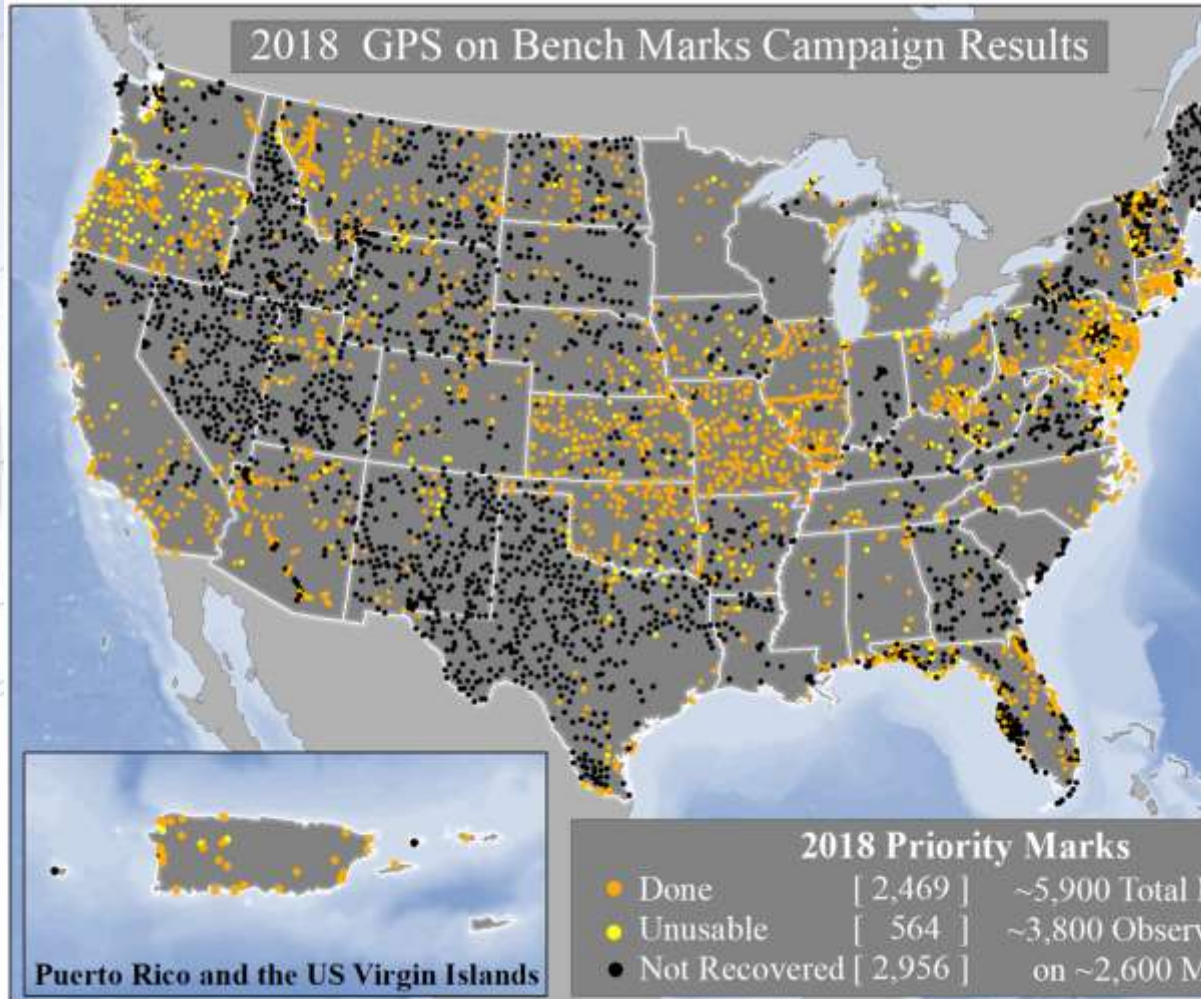
- Improved Geoid18 - the last hybrid geoid for NAVD 88
- 2020.0 Reference Epoch Coordinates (REC's)
- Data for NAVD 88 – NAPGD2022 Transformation Tools
- Build time series of observations in areas of motion

Added benefits:

- Evaluate gravimetric geoid models
- Check your RTN results
- Update and maintain passive control marks
- Identify marks suspected of movement



GPSonBM & Geoid 18 - last hybrid geoid for NAVD88

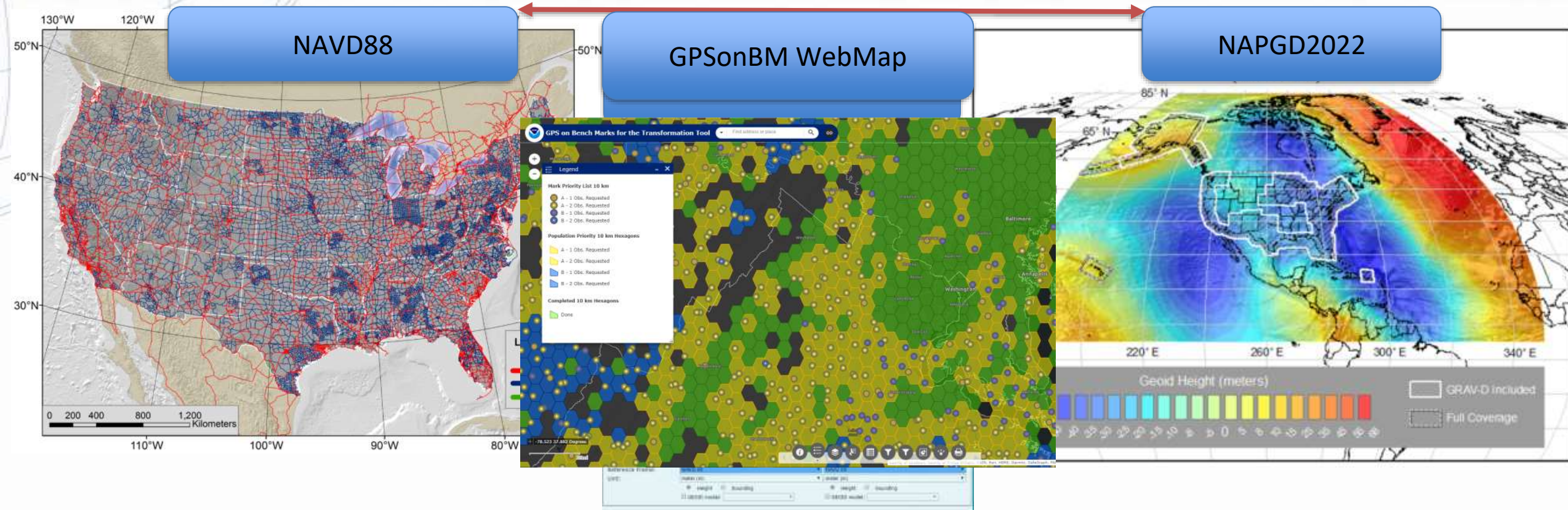


- an increase of ~6,800 marks (26%) over GEOID12B

Estimated uncertainty – how well the model matches published NAVD88 orthometric heights

GPS on Bench Marks is currently crowdsourcing data to improve the local accuracy of the NAVD 88 - NAPGD2022 Transformation Tool

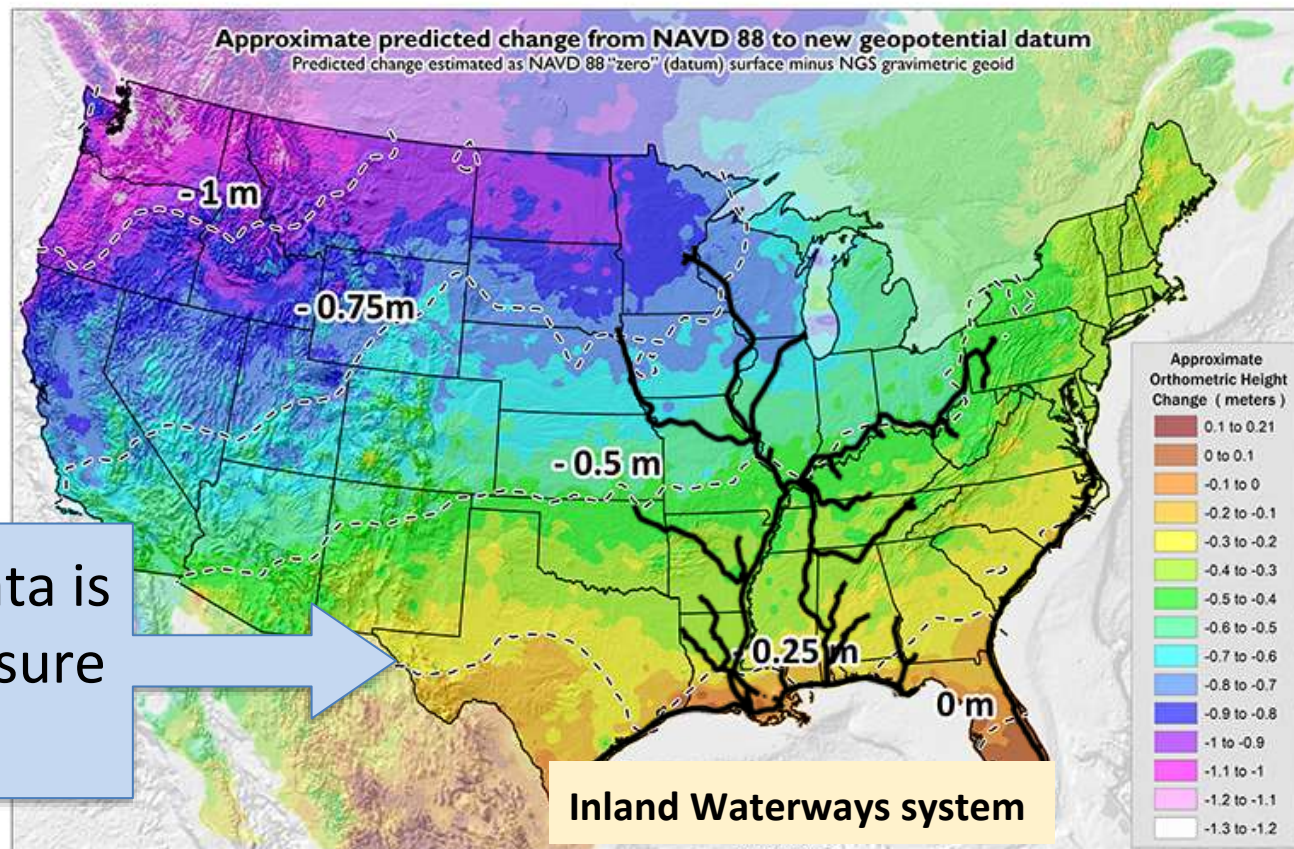
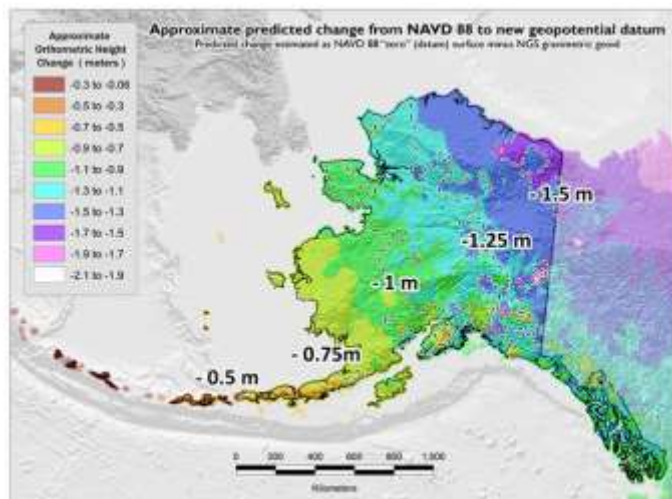
NGS will make a **national scale, mapping grade** transformation tool with the data we have in the NGS Database and Shared through OPUS. We have set a goal of 10 km spacing across the nation and by necessity must interpolate over areas with data gaps.



GPSonBM Measurements Connect Current and Future Datums

The relationship between the old and new datums vary by location. GPSonBM data is used to measure that relationship. The accuracy of the transformations in any particular place will be directly related to the density of GPSonBM data available in that area.

In moving from NAVD 88 to NAPGD2022, there will be a Shift: A one-time 0 to 2 meter jump in orthometric heights
 -From fixing biases and/or tilts in NAVD 88



GPSonBM data is used to measure the Shift

Contact the GPSONBM team:
ngs.gpsonbm@noaa.gov

Provide Feedback:
ngs.feedback@noaa.gov

How Can You Prepare

Stay up to date and check available resources

- Participate in NGS webinars, Geospatial summits, and online training
- Contact NGS Regional Advisor

Metadata is **essential**

- Improves reliability and accuracy of data
- Increases value and usefulness

Consider whether to transform old data and/or collect new data

- Know your accuracy requirements

How Can You Prepare

Require/provide complete metadata for all mapping contracts

- What datum(s)
- How data was collected and processed

Preserve all original observations

- particularly when referenced to ellipsoid (GNSS)

Use Complete Nomenclature

NAD83

NAVD88

MLLW

Use Complete Nomenclature

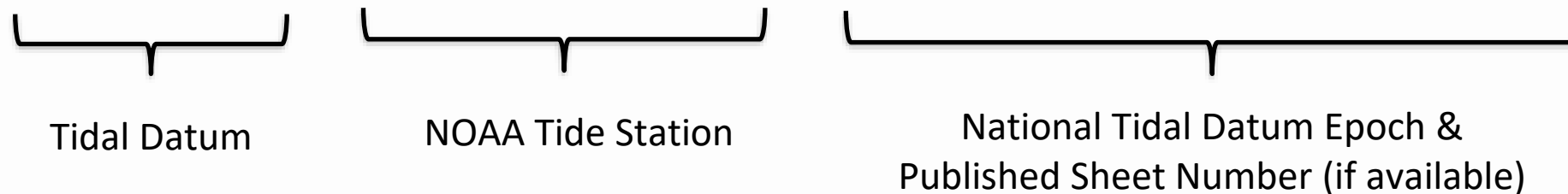
NAD83(2011) epoch 2010.00

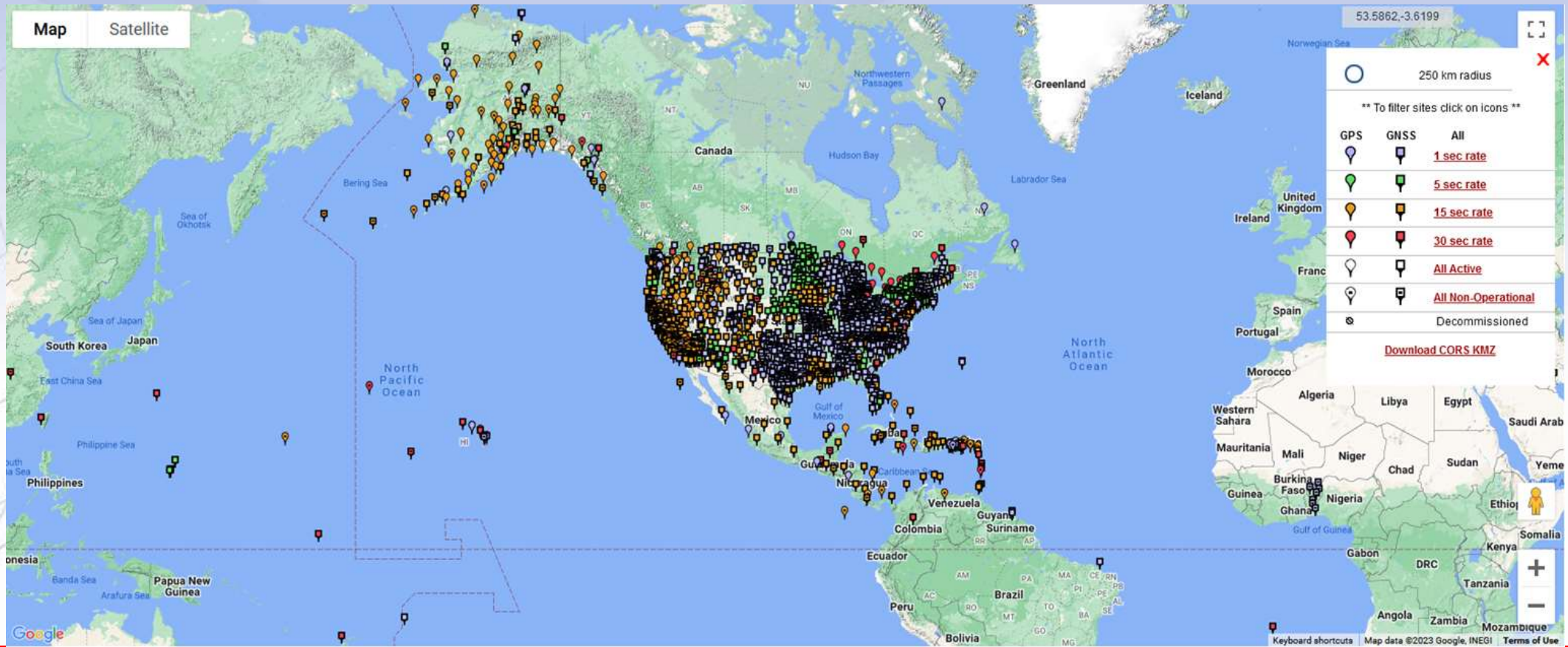


NAVD88 (*GRS80, GEOID18*)



MLLW(9452210; 1960-78 #2128)





BT

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Tools: New and In Progress

- OPUS - Single point solutions
- [OPUS Projects 5.1](#) - Geometric solutions for Campaign GNSS
 - Calls OPUS but organizes and adjusts campaign data
 - Upload real-time (RTK) and post-processed vectors via GVX format
 - Export adjustments to various geospatial formats
 - OPUS 6 will also adjust leveling data but is still IP
- There will be a new leveling manual out next year
 - Must Include 3+ GNSS occupations on points 30 km or more apart
- Updating the Leveling Online Computations User Service [LOCUS](#) to support leveling adjustments until OPUS 6

New types of Coordinates

Reference Epoch Coordinates

- An estimated “snapshot” of entire network
- Every 5 or 10 years
- Similar to NAD 83(2011) epoch 2010.00

Survey Epoch Coordinates

- Time-dependent!
- Reflects coordinates at the time of observation
- Multiple Survey Epoch Coordinates (SECs) can show changes over time

NGS Products Update - NCAT

The screenshot shows the NOAA National Geodetic Survey website. At the top left is the NOAA logo. The main header reads "National Geodetic Survey" with the tagline "Positioning America for the Future". Below the header is a navigation menu with tabs for "NGS Home", "About NGS", "Data & Imagery", "Tools", "Surveys", "Science & Education", and a search box. A red arrow points to the "Tools" tab, which has a dropdown menu open. The dropdown menu lists several options: "Adjust Leveling (LOCUS)", "Geodetic Tool Kit", "Web Services", "Process GPS data (OPUS)", "Coordinate Conversion and Transformation Tool (NCAT)", "Vertical Conversions (VDATUM)", "Download PC Software", "GEOID12B Toolkit", "GPS Toolbox", "HTDP", and "VERTCON". A second red arrow points to the "Coordinate Conversion and Transformation Tool (NCAT)" option. Below the navigation menu is a red-bordered box with a warning icon and the text "NOTICE: View NOAA Emergen...". To the left of the main content area is a "Quick Links" sidebar with various links such as "OPUS", "CORS", "Survey Mark Datasheets", "NGS Data Explorer", "OPUS Projects", "Geodetic Tool Kit", "State Plane Coordinates", "Antenna Calibration", "UFCORS", "GEOID", "GPS on Bench Marks", "Geodetic Advisors", "Storm Imagery", "Publications", "2019 Geospatial Summit", "FAQs", and "Contact Us". Below the sidebar is a "Subscribe for email notifications" button and a "Coming in 2022" graphic. The main content area features several product update cards: "GNSS & GPS Data" (Get coordinate information and the tools you need to work independently. Learn More), "Remote Sensing" (Download data and critical information into nautical charts. Learn More), "Land Surveying" (View guidelines and get tools to support land surveyors.), and "Geodesy" (NGS works closely with the global researchers advancing geodetic science.). On the right side, there are three more sections: "Looking for Bench Marks?", "Product Updates" (Final Releases: CORS ITRF2014 Coordinates, GEOID18), and "In the News" (9/6/2019 - NGS Conducts Geodetic Survey to Support U.S. Coast Guard, 8/23/2019 - NGS Contributes to Defining a Global Geodetic Reference Frame, 8/16/2019 - Software).

NGS Products Update - NCAT

Single Point Conversion
Multipoint Conversion
Web services
Downloads
About Conversion Tool

Convert from: LLh SPC UTM XYZ USNG


Enter lat-lon in decimal degrees

Lat:
 Lon:

or degrees-minutes-seconds

Lat:
 Lon:

or drag map marker to a location of interest







Ellipsoid Height (m):

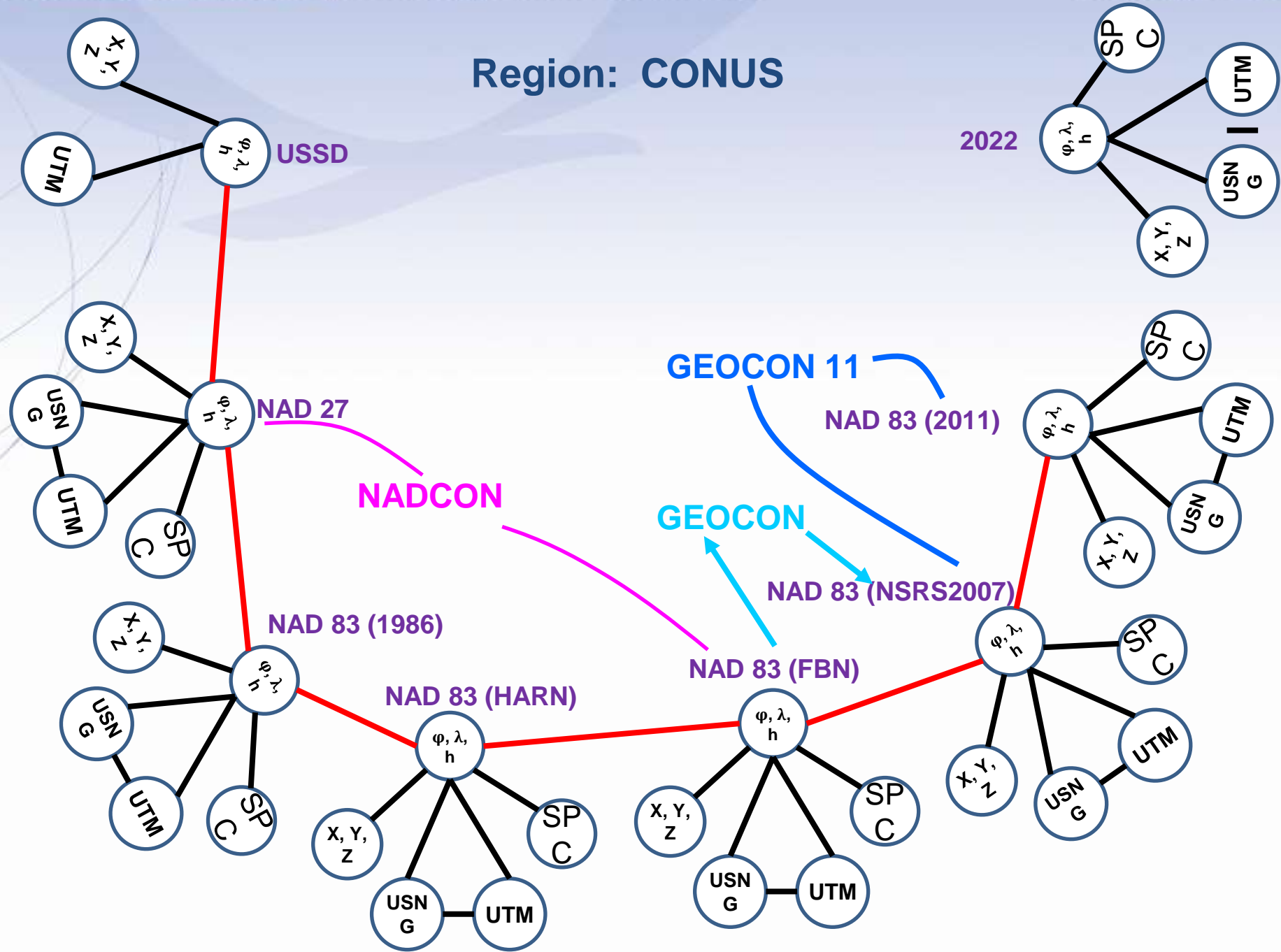
Input datum: Output datum:

Don't see a datum in the list? Click here to learn more.

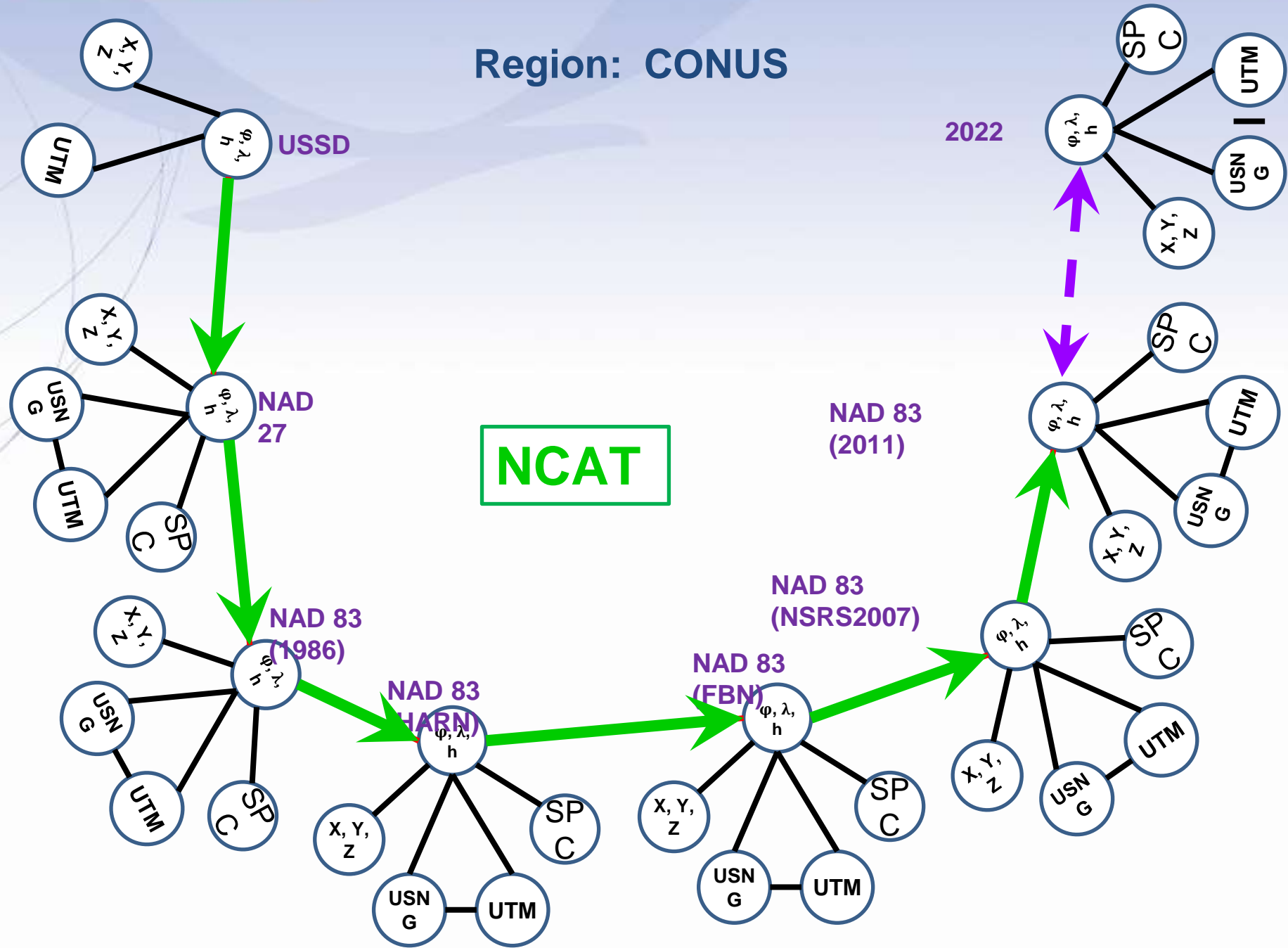
Converted coordinates will be in output datum.

Export Results to:    

Region: CONUS



Region: CONUS



Tools available in 2025 (rollout)

A new least-squares adjustment suite: LASER

- Least-squares **A** adjustments: **S**tatistics, **E**stimates and **R**esiduals
- Replaces all existing NGS LSA software
 - ADJUST, ASTA, CALIBRAT, others
- Supports 3D networks (GNSS+total station), leveling, CBLs, gravity networks
- C++, no Helmert blocking needed, numerous support tools
- Will be the main engine in OPUS for the modernized NSRS

A common geodetic data format: GDX

- In 2021, NGS released GVX
 - GNSS Vector Exchange format
 - After lengthy discussions with industry
 - Today, OPUS and many industry receivers make use of GVX
- In 2022, NGS announced it will replace GVX with GDX
 - Geodetic Data Exchange format
 - Expands upon and corrects some issues with GVX
 - Supports data from:
 - GNSS receivers, total stations, levels and relative gravimeters
 - Will replace GVX in late 2023

A common grid format

- USA and Canada are nearing an agreement on a common grid format
 - When finalized:
 - **Future** gridded products from either country's geodetic agencies will be in the chosen format
 - Work will begin translating **existing** gridded products to the chosen format
 - Current leading candidate: **GGXF**
 - This is pre-decisional

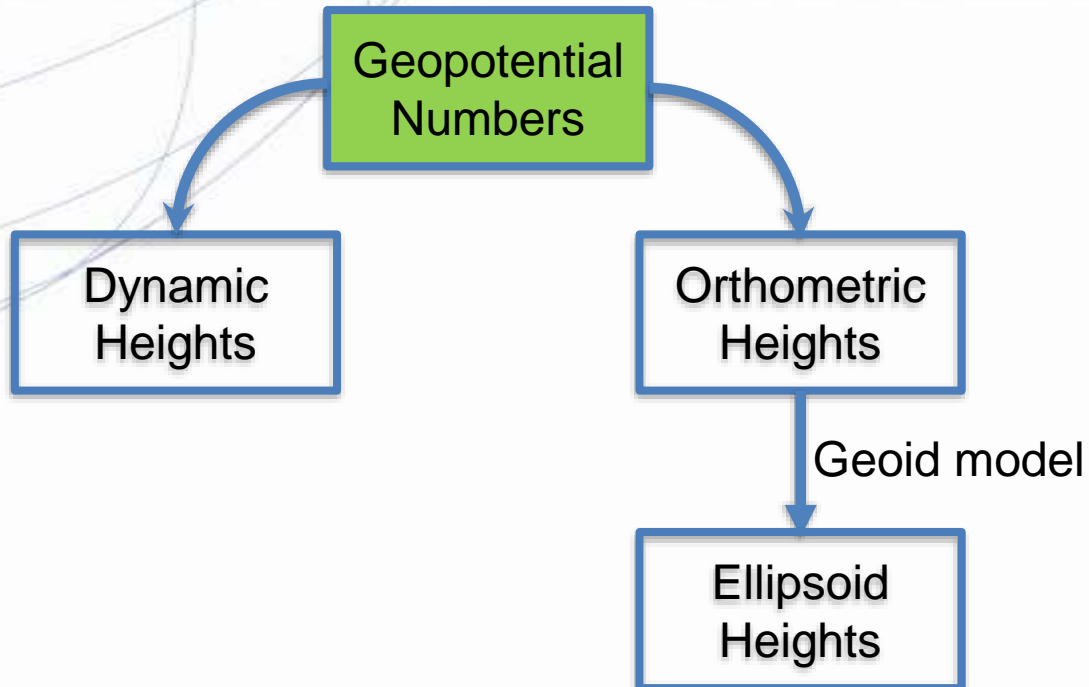
GeoTIFF? GeoPDF?

ASCII?

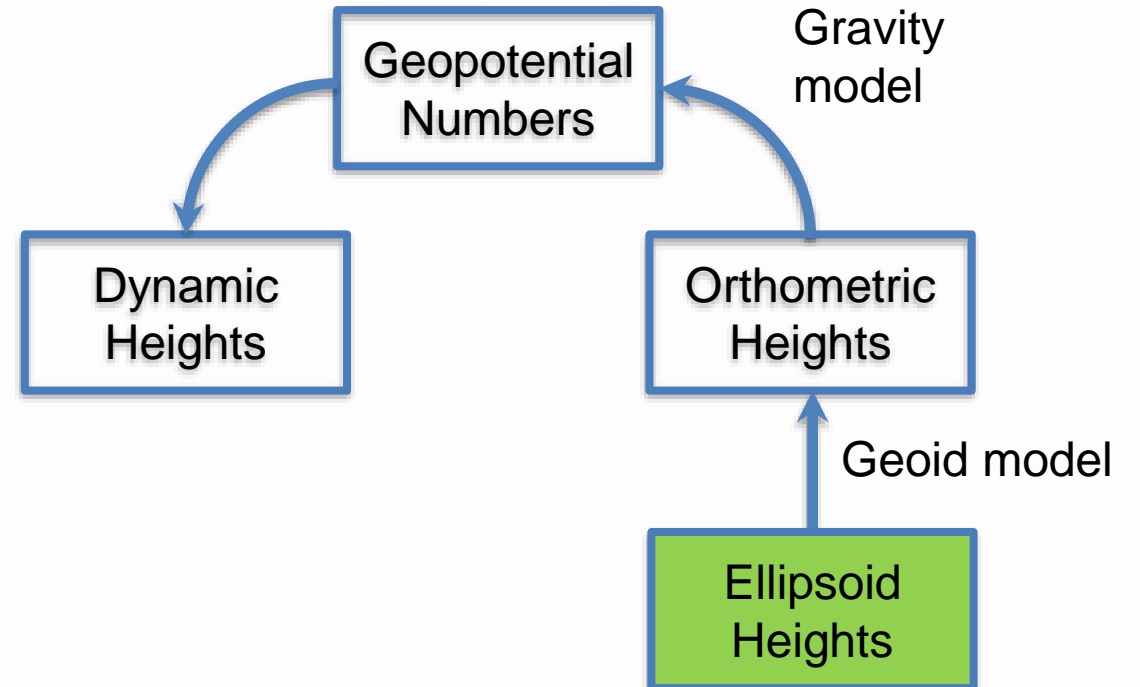
GGXF?

Dynamic Heights from GPS

- Current NSRS relations:



- Modernized NSRS relations:



Reference Epoch Coordinates

- Geometric
 - Epoch: 2020.00
 - ITRF2020
 - Then to N/P/C/MATRF2022
 - All GNSS and classical observations
 - Constrained to GRPs at CORSs
 - ~115,000 pts will get XYZ coords
 - Then to lat/lon/eht
 - Then to orthometric and dynamic heights
- Orthometric
 - Epoch: 2020.00
 - NAPGD2022
 - All leveling observations
 - Constrained to Geometric RECs + GEOID2022 (orthometric constraints)
 - ~960,000 pts will get H coords
 - Then to eht and dynamic heights

OPUS

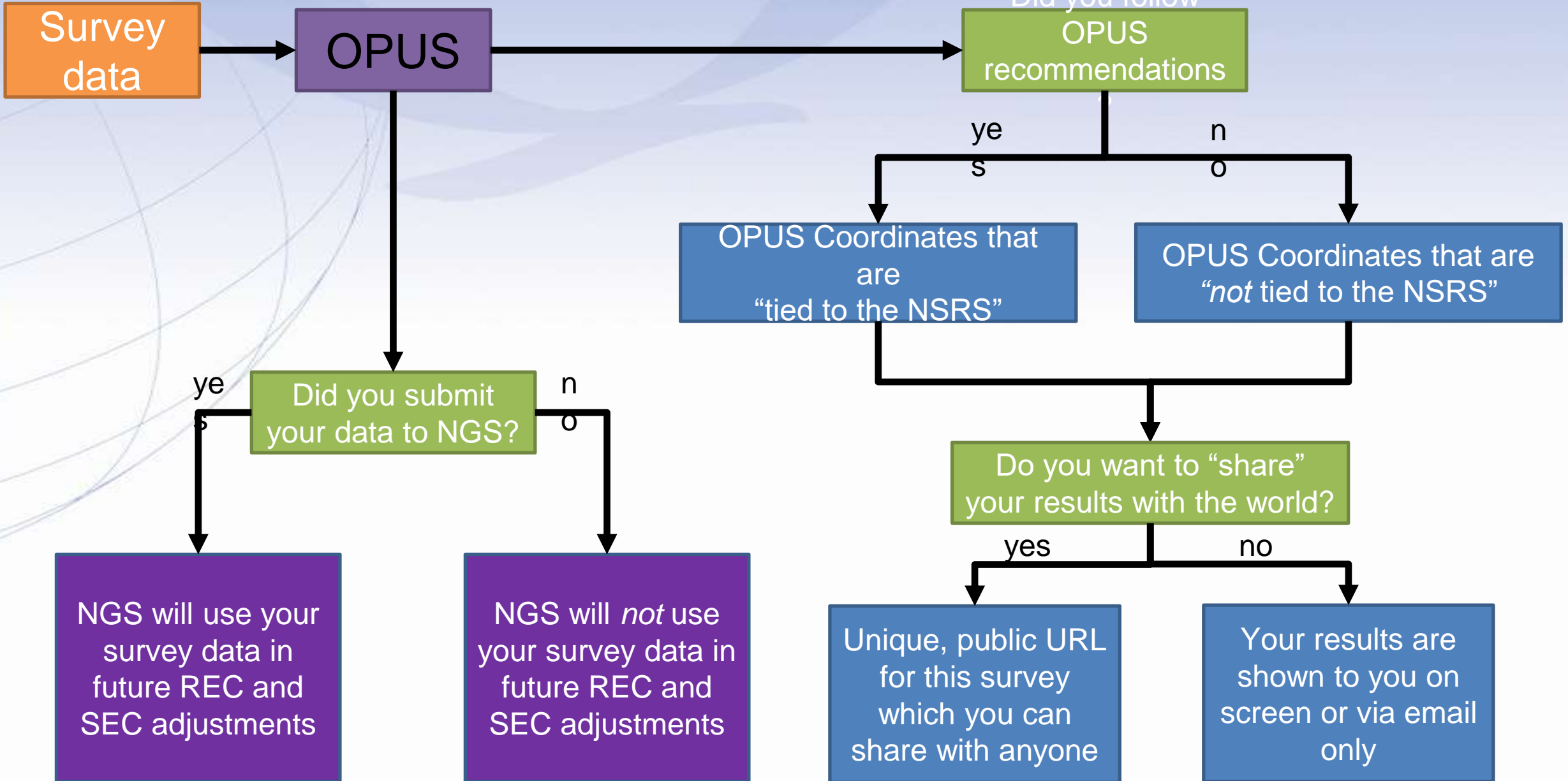
- OPUS-S and OPUS-Projects are being *transitioned*
 - From current NSRS to modernized NSRS



- Both current and modernized:
 - GNSS only (for now)*
 - ITRF2020
 - M-PAGES (multi constellation)
 - Simultaneous GNSS vector processing

- Modernized:
 - GDX, not bluebooking
 - LASER, not ADJUST
 - Choose your epoch
 - N/P/M/CATRF2022
 - IFDM2022, not HTDP
 - OPUS recommendations
 - OPUS coordinates

* OPUS 6 will come *after* 2025



NADCON

- Current version: 5.0.1
 - Expansion will bridge current NSRS to modernized NSRS

Region	Current	Modernized
CONUS	NAD 83(2011) epoch 2010.00	NATRF2022 epoch 2020.00
Alaska	NAD 83(2011) epoch 2010.00	NATRF2022 epoch 2020.00
Hawaii	NAD 83(PA11) epoch 2010.00	PATRF2022 epoch 2020.00
PR / USVI	NAD 83(2011) epoch 2010.00	CATRF2022 epoch 2020.00
American Samoa	NAD 83(PA11) epoch 2010.00	PATRF2022 epoch 2020.00
Guam / CNMI	NAD 83(MA11) epoch 2010.00	MATRF2022 epoch 2020.00

VERTCON

- Current version: 3.0.0
 - Expansion will bridge current NSRS to modernized NSRS

Region	Current	Modernized
CONUS	NAVD 88	NAPGD2022 epoch 2020.00
Alaska	NAVD 88	NAPGD2022 epoch 2020.00
Hawaii	<i>Has no defined vertical datums. VERTCON will not work here.</i>	
PR	PRVD02	NAPGD2022 epoch 2020.00
USVI	VIVD09	NAPGD2022 epoch 2020.00
American Samoa	ASVD02	NAPGD2022 epoch 2020.00
Guam	GUVD04	NAPGD2022 epoch 2020.00
CNMI	NMVD03	NAPGD2022 epoch 2020.00

Data Delivery System

- Everything NGS uses will be stored in the NSRS Database
- Requests made of that database will go through the Data Delivery System (DDS)
 - “Datasheets” are being designed for MARKS and STATIONS
 - Similar to, but much better than existing datasheets
 - Support for querying about other things (papers, models, surveys, adjustments, etc.) will be added over time

What will have to wait...

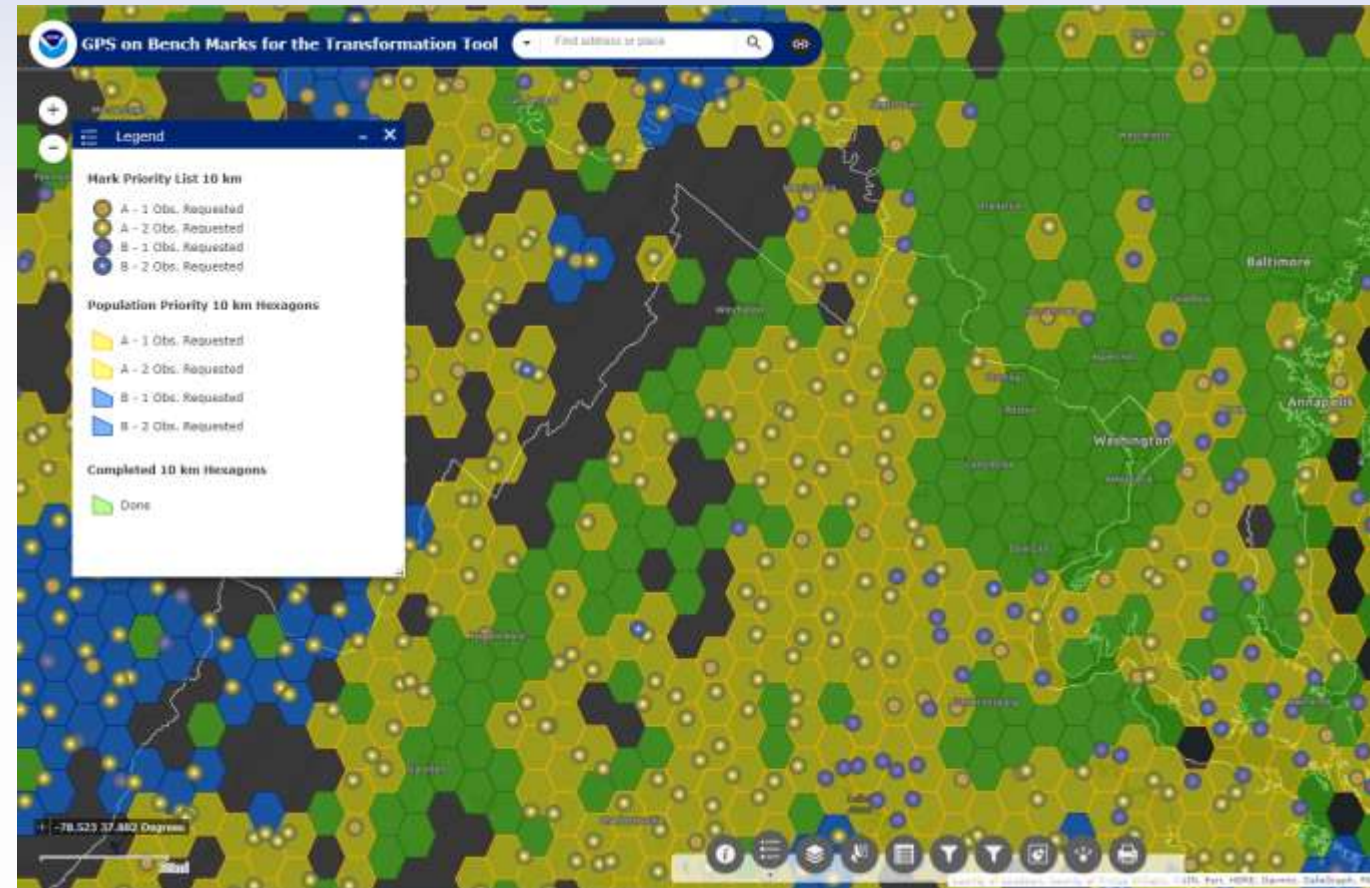
- Promises we intend to keep, but not until after the initial release of the modernized NSRS include:
 - Integrating leveling, classical data and gravity into OPUS
 - Full integration of all old tools into NCAT and Vdatum
 - SECs for pre-1994 (AKA “pre-NCN”) years, plus SECs for post-2020

Summary

- Align NSRS to ITRS (ITRF2020)
- International agreements
 - UN GGRF
 - SIRGAS/Americas
 - Pacific
- Meets U.S. Law (GDA)
 - F.A.I.R.
 - Geoplatform and Data.gov
- Modernized NSRS
 - Four new TRFs
 - One new Geopotential datum
- Blueprints describe
- GPS on BM for better transforms
- Keep GNSS obs/metadata
- New tool to transform - NCAT
 - 14-parameter/grids for realizations
 - OP 5.1 for Campaign GNSS
 - LOCUS for leveling
- Future OP tool will adjust leveling

Get Prepared

- **Evaluate your business models, practices and geospatial data**
 - Transform Data - [NCAT](#)
 - Record metadata - time/date/CRS
 - Perform GPS on BM operations
 - Will improve conversion grids
 - Review SPCS 2022
 - Prepare to update legislation
 - Some states have codified NAD 83
 - Need to make non-unique
 - Use NSRS - not specific realization
- **Keep your GNSS Observations**
 - Can re-run in later realizations



Points of Contact

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- [Regional Geodetic Advisers](#)
- [NGS Webpage](#), [Presentation Library](#)
- [Publication Library](#), [Webinars](#)
- [Educational Videos](#)



DISCUSSION

**Moderator
Mr. Galen Scott**



Aviation



CORS



**Satellite
Operations**



Precision Agriculture



**Surveying
and Mapping**



Disaster Response



**Personal
Navigation**



Trucking and Shipping



Navigation



Oil Exploration



Fishing and Boating

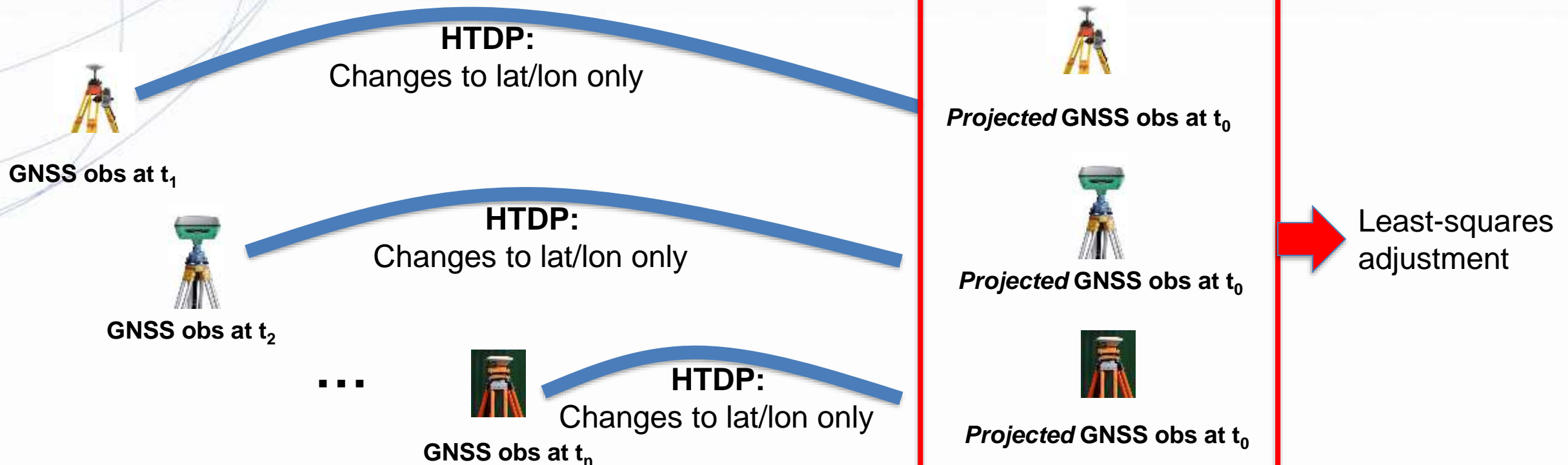


Survey Marks

Extra Slides

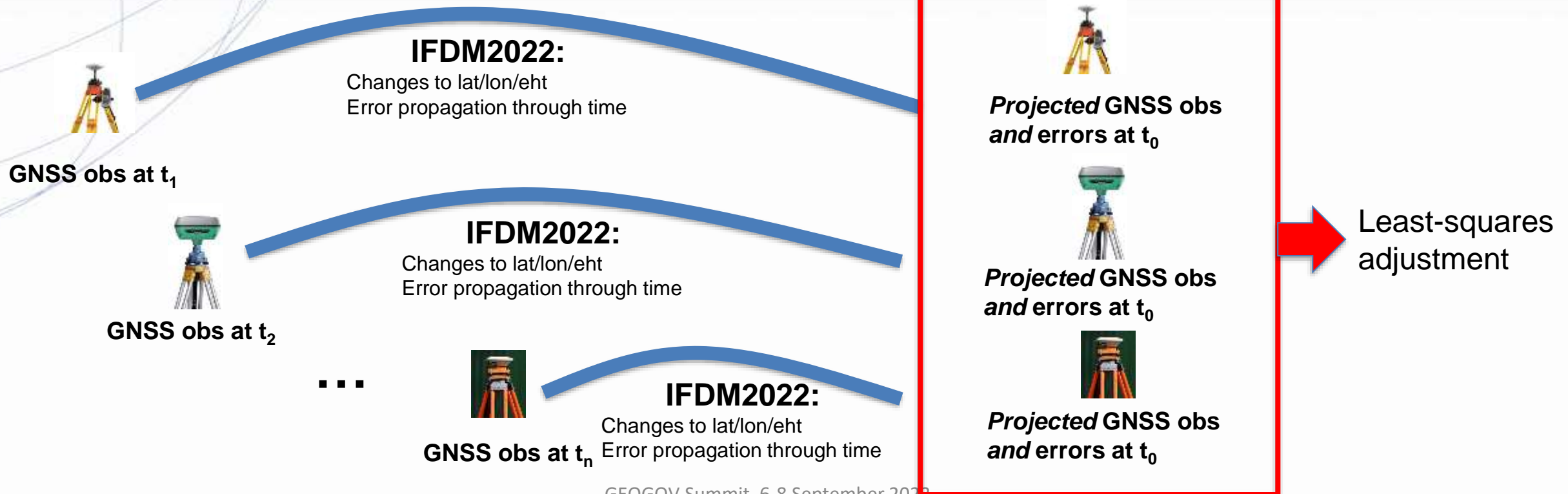
Science behind the tools: replacing HTDP

Currently:



Science behind the tools: replacing HTDP

- “The multi-epoch least-squares adjustment problem” (ME-LSA)
 - [NOAA TR NOS NGS 79](#)



Tools available after 2025

Static GNSS



RTK/RTN



Classical



Leveling



Rel. Gravity



RINEX
RINEX
RINEX
RINEX

GDX
GDX
GDX
GDX

GDX
GDX
GDX
GDX

GDX
GDX
GDX
GDX

GDX
GDX
GDX
GDX

- Upload multiple types of data and multiple files into a single survey project
- Process RINEX into a position (like today's OPUS-S)
- Process RINEX into mark-to-mark vectors

- Process Classical into mark-to-mark angles/distances
- Process Leveling into mark-to-mark ortho. differences
- Process Rel. Gravity into mark gravity
- Combine GNSS, RTK/N, Classical in a Geometric Adjustment
- Combine Classical and Leveling in an Orthometric Adj.
- Adjust Relative Gravity for either gravity or vertical gradients in a Gravimetric Adjustment
- Special settings for Calibration Base Lines
- Choose your epoch and frame
- All coordinates returned are *OPUS Coordinates*

OPUS 6

- Submit your data to NGS for QA/QC, database loading, and improvement of future passive mark coordinates (RECs and SECs)