



Preparing for NSRS Modernization:

Guidelines for governments, corporations and individuals

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Outline

- Brief overview
 - 4 new reference frames and 1 new geopotential datum
 - New Types of Coordinates
 - Data vs Tools
 - Timeline
- Six steps to prepare yourselves for the transition

Brief overview

Federal Users of the NSRS



Brief overview:

4 new reference frames and 1 new
geopotential datum

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)

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

GEOID12B

DEFLEC12B

The New:

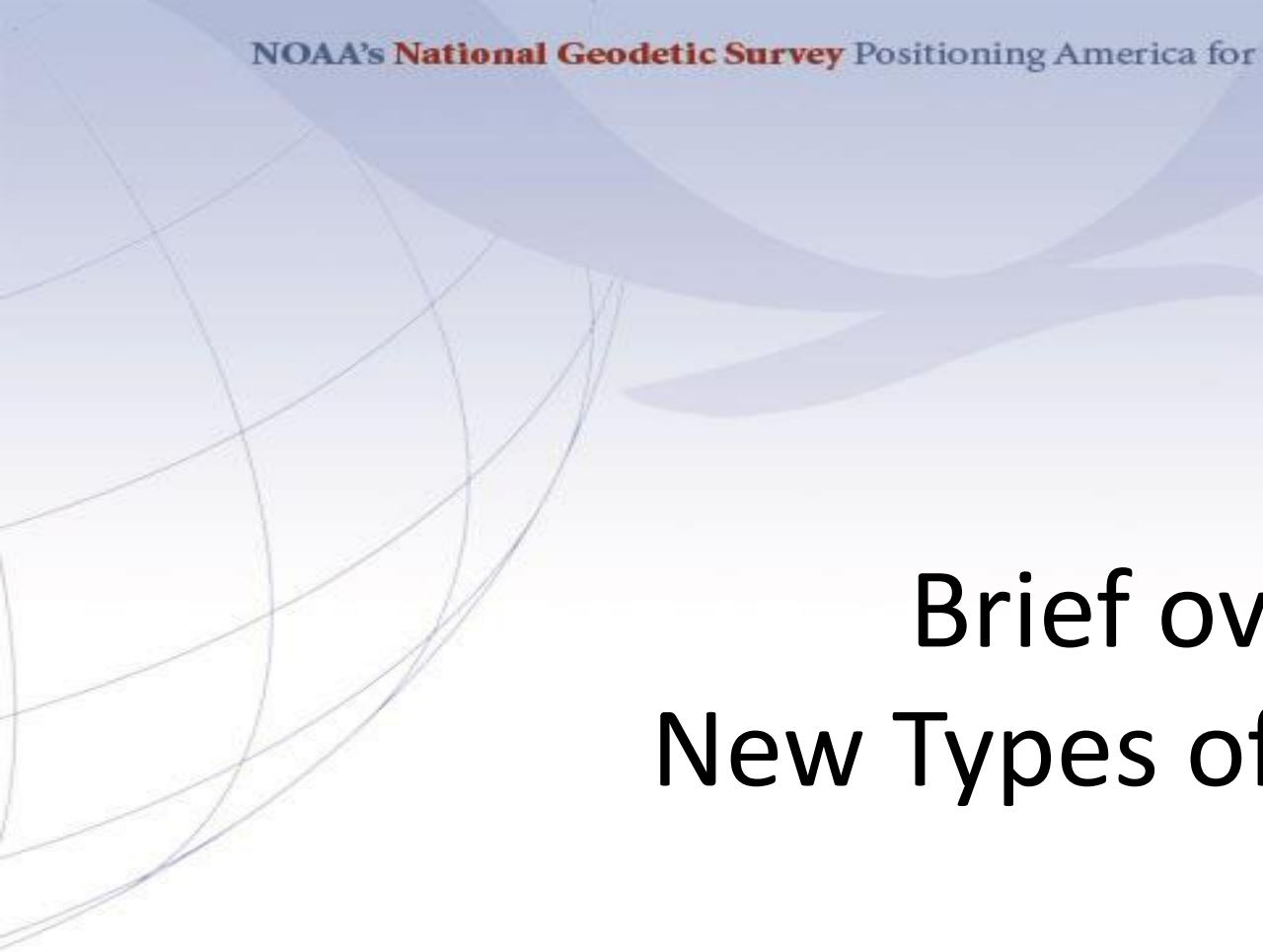
The North American-Pacific **Geopotential Datum** of 2022 (NAPGD2022)

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



Brief overview: New Types of Coordinates

A two-track approach to 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 time of observation
- Multiple SECs can show changes over time

Re-prioritization: a “data first” approach

Re-prioritization

- There are 33 active projects within NGS explicitly dedicated to NSRS modernization
 - In an agency of ~200 people....resources are spread *thin*
- Meanwhile the current NSRS slowly deteriorates
 - Marks subside without checking
 - CORSs drift away from their published coordinate functions
 - The passive control network deviates from active control

Re-prioritization

- NGS has recently decided to release all of the modernized NSRS **data** before we have fully completed all support **tools**
- ***If we do not take this approach, we are not likely to see the modernized NSRS defined and released until 2030***

Data

- Upon release, the modernized NSRS will consist of this *data*:
 - The NOAA CORS Network (NCN) operating on **ITRF2020**
 - **NATRF2022, PATRF2022, MATRF2022, CATRF2022** defined relative to ITRF2020
 - **NAPGD2022**, including:
 - GM2022, GEOID2022, DEFLEC2022, GRAV2022
 - Geometric (XYZ / $\phi\lambda h$) and orthometric (H) **reference epoch coordinates** (RECs) at 2020.00 at those passive control with the observations to support such coordinates
 - Geometric (XYZ / $\phi\lambda h$) and orthometric (H) **survey epoch coordinates** (SECs) at survey epochs between about 1994 and 2020 at those passive control with the observations to support such coordinates
 - **State Plane Coordinates** of 2022 (SPCS2022), plus UTM and USNG
 - **NADCON**
 - Connecting NAD 83(2011/MA11/PA11) epoch 2010.00 to N/P/M/CATRF2022 epoch 2020.00
 - **VERTCON**
 - Connecting NAVD 88, PRVD02, ASVD02, NMVD03, GUV04 and VIVD09 to NAPGD2022 epoch 2020.00

Tools

- At a minimum, NGS is targeting these tools upon release:
 - A **DDS** capable of yielding:
 - RECs on some kind of datasheet
 - Information on CORSs
 - A downloadable version of **LASER**
 - **A browser-based online multi-GNSS service:**
 - Like OPUS-S
 - Like OPUS-Projects 5.x
 - **NCAT** and **Vdatum** capable of invoking **NADCON**, **VERTCON** and **SPCS2022**

What comes after...

- Next steps 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

Timeline

Timeline

- Resources are being diverted from tool building to the assurance of quality *data* first and foremost
- As such, based on this new approach, NGS anticipates the release of all data, and limited tools, by the **middle of 2025**.
- Work on additional tools will continue in the out-years

Preparing yourselves:

Six steps to successfully transitioning to the modernized NSRS

Stay Calm

- **Many ways of doing business will stay the same**
 - Static coordinates, like NAD 83(2011) epoch 2010.00 are now “RECs”
 - Leveling remains the most accurate way to measure local height differences
- **Many new tools will (finally) support long-established practices**
 - OPUS-Projects now supports RTK/N data
 - Low-distortion projections will be in SPCS2022

Stay Calm

- **Many new things are helpful, but optional**
 - SECs will show time-dependency on passive marks, but shouldn't be used as geodetic control
 - The ITRF is the foundation of the modernized NSRS, but you aren't required to use it
- **NADCON and VERTCON will be there for you**
 - Every latitude, longitude and height will change by decimeters to meters overnight
 - But these changes will be modeled into NADCON and VERTCON at release

Familiarize yourself with the modernized NSRS

- **Read the Blueprint documents, especially #3**
 - <https://geodesy.noaa.gov/library/>
- **Check out the presentation library**
 - https://geodesy.noaa.gov/web/science_edu/presentations_library/
- **Check out the NGS webinar series, new and old:**
 - https://geodesy.noaa.gov/web/science_edu/webinar_series/
- **Subscribe the NSRS Modernization newsletter:**
 - <https://geodesy.noaa.gov/datums/newdatums/TrackOurProgress.shtml>

Ask those agencies and companies that you rely on about *their* transition plans

- **Despite previous mandates from the FGCS, some federal agencies took years to get onto the current NSRS, if at all...**
 - Some still use the 1912 vertical datum
 - Never heard of it? It came *before* NGVD 29, which came before NAVD 88 which is about to be replaced
- **Many companies are quick to adopt**
 - Contact your reps at ESRI, Trimble, Blue Marble, Leica, Topcon, Javad, MicroSurvey, etc.
 - Many of them have been in contact with NGS and so we expect their software to support things quickly

Organize your historic data archives

- **When a new frame or datum is released, NGS always recommends these choices, in decreasing order of accuracy:**
 - Re-survey points of interest
 - Re-adjust old observations to control in the new system
 - Transform using NADCON and/or VERTCON
- **Your fastest, but least accurate, way to get into the modernized NSRS is through NADCON and VERTCON**
 - Built into NCAT and Vdatum
 - Available publicly, so software vendors can incorporate it into their products and services

Check out NGS tools as they are released

- **Updates to OPUS-Projects 5.x coming soon will lean us into the modernized NSRS:**
 - M-PAGES for multi-GNSS processing
 - No more bluebooking
 - Use of ITRF2020
 - New methods of doing LSA with new tool “LASER”
- **SPCS2022 released by end of CY2022**
- **Alpha versions of NADCON and VERTCON by end of CY2023**

Embrace the future

- **The planet is round, dynamic and complicated**
 - Consider switching to the ITRF
 - Do not expect coordinates to stay the same for years
- **Passive marks have a very new role**
 - Monitoring motion, not holding a static coordinate indefinitely
 - Tie your surveys to the NOAA CORS Network
- **Going leveling? Pack your GNSS equipment!**
 - Leveling won't yield absolute heights without height control, which will come from GNSS + geoid

In summary...

- Big changes are coming
- You can prepare if you
 - Stay Calm
 - Familiarize yourself with the modernized NSRS
 - Reach out to agencies and companies upon which you rely
 - Organize your historic data archives
 - Check out NGS tools as they are released
 - Embrace the Future



Thank you!

Questions?