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# Practical Impacts of the Modernized NSRS

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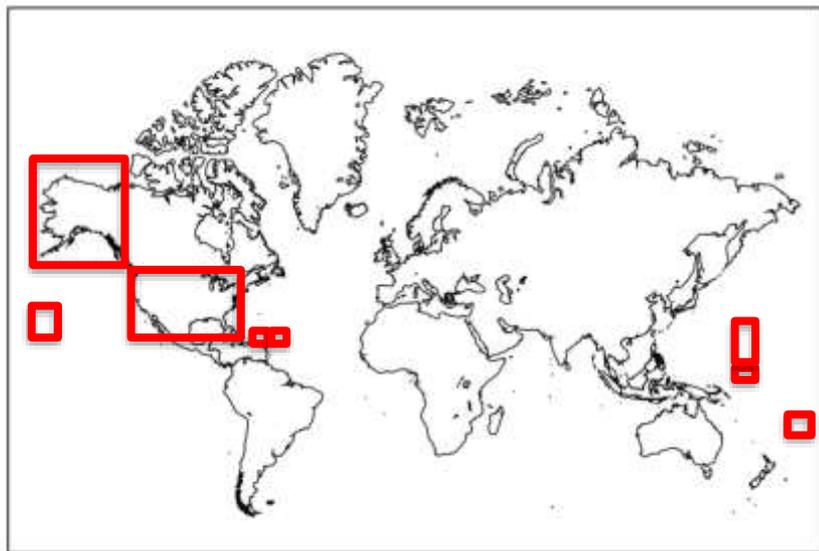
# Outline

- A very brief overview of NSRS Modernization
- Practical Impacts
- Tools for a changing world

# The National Spatial Reference System

- The NSRS
- Official coordinate system for the USA
- Defined by the (USA) National Geodetic Survey
- Required to be used by all (USA) Federal Government agencies
- Often used by many (USA) state and local government agencies or private surveyors

# Extent of the current NSRS



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

**Conterminous US (CONUS; “Lower 48”)**

**Alaska**

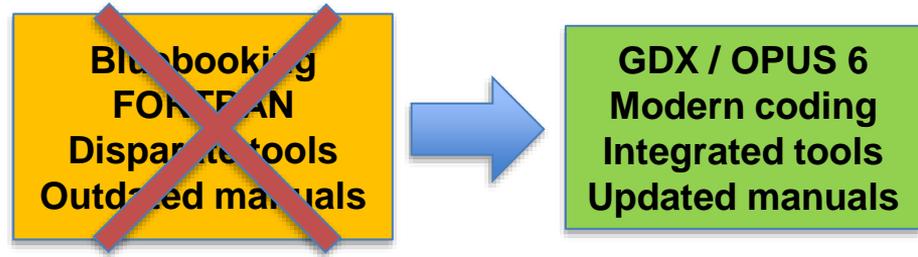
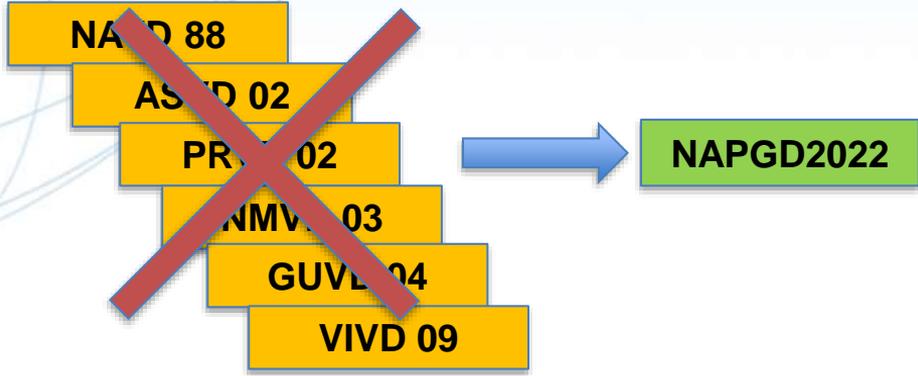
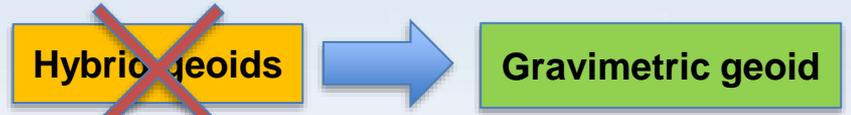
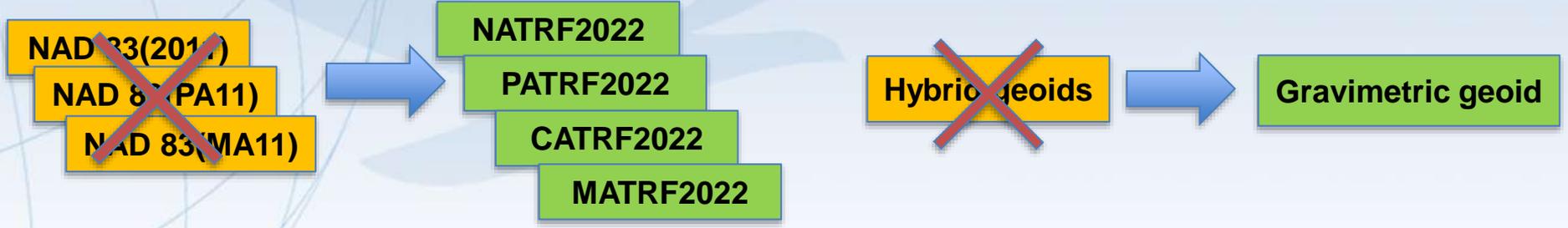
**Hawaii**

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

# NSRS Modernization in (very) brief – Why?

- The current NSRS was:
  - Defined in the pre-GPS era
    - Without GPS, the Earth's center (frame origin) was very hard to detect
  - Defined without aid of gravity-mission satellites
    - Leveling, terrestrial gravity, disconnected from the geometric frame
  - Defined right after punch-cards went away
    - Tools relied upon 80-character ASCII files and FORTRAN
  - Defined without a long-term strategy to acknowledge Earth's dynamics
- In short, the current NSRS has failed to keep up with emerging needs
  - Sea level rise, floodplain mapping, coastal geohazards

# NSRS Modernization in (very) brief



# 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

# Practical Impacts

- One day, every digital surveying instrument could be capable of providing direct input to OPUS 6 via GDX
  - GDX: **Geodetic Data Exchange** format. Can hold raw measurements from GNSS receivers, levels, total stations, gravimeters
  - **OPUS 6**: NGS's future do-it-all geodetic survey project processing tool
- **Time-dependency** will be built into the modernized NSRS. Users will need to actively disengage it.

# Tools for a changing world

- Before working in the modernized NSRS, most users want to know how to get their decades of existing data into it
- There are always three ways

Method	Accuracy	Cost
Re-survey	High	High
Re-adjust	Medium	Medium
Transform	Low	Low

# Tools for a changing world

- **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 NADCON and VERTCON (NGS models) estimate mass-changes to your datasets.
    - Does not yield new “geodetic control”

# Re-survey or Re-adjust

- 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

# Transform

- Using all GNSS and leveling data ever provided to NGS, we will create updates to NADCON and VERTCON
  - Available in NCAT and VDatum
- Will get your data to the 2020.00 epoch in the new frames / new geopotential datum

# Timeline

- NGS will release all modernized NSRS data and many support tools on their BETA website over the 2024-2025 timeframe
  - Because the creation of some data/tools are the prerequisites for creating other data/tools, some parts of the modernized NSRS will be on BETA for over a year, while others for only a few months
- Once everything has been publicly available for 3 months, the FGCS will meet to decide on adopting the whole package
  - FGCS: Federal Geodetic Control Subcommittee. Under the FGDC (Federal Geodetic Data Committee)
  - With a positive vote, everything moves from BETA to the live NGS page
- NGS expects this vote in late 2025

# Early release

- Some data/tools can and will be released early
  - This was a request from industry partners
- Such early-releases (“alpha products”) aren’t usually publicly available, so this will only be true for a handful of things
  - SPCS2022
  - EPP2022
  - GEOID2022
  - A few others

# Early release

- Alpha products are, by definition, any or all of the following:
  - Incomplete
  - Inaccurate
  - Buggy
  - Subject to change without notice
- As such, their early release is primarily to see the “big picture” such as formats of data, a general direction that NGS is taking, etc.

# What's on deck?

- Soon: M-PAGES in OPUS-S
- Soon: GDX to replace GVX
- Soon: The release of the State Plane Coordinate System of 2022
  
- Late 2023: The first (“alpha”) set of RECs in N/P/C/MATRF2022 on 100,000+ marks
- End of 2023: ITRF2020 coordinate functions on all NOAA CORS Network stations
- End of 2023: First (“alpha”) release of GEOID2022 (“GEOID2022 Beta v. 0.1”)

A stylized background featuring a light blue globe on the left side with a grid of latitude and longitude lines. To the right of the globe, there is a faint, light blue map of the United States. The overall background is a gradient of light blue and white.

# Thank you!

# Questions?

# Extra Slides

# What's on deck?

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# Thank you!

# Questions?

# Extra slides

# The path to full roll-out (1 of 2)

- Complete data and tools that have been tested internally will be released on the beta website.
- Once the complete package of modernized data and tools have been on beta for at least 3 months, NGS will ask FGCS to formally adopt the modernized NSRS
- After that vote, all modernized data and tools on the beta website will be moved, en masse, up to the live website
- We will all celebrate and relax because this process can't possibly have any hiccups

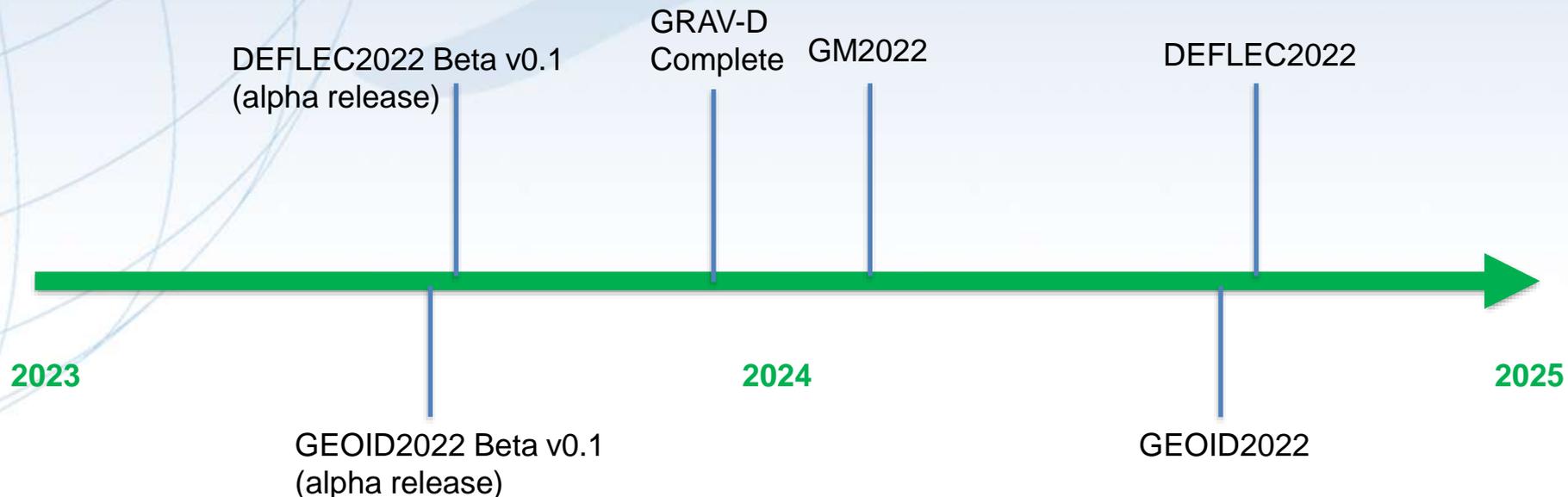
# The path to full roll-out

- The next few slides show key elements, and their roll-out order, though with a purposefully vague timeline to allow some flexibility
- To aid in readability, some details are omitted, but can be inferred, such as:
  - All data will be loaded in the NSRS database
  - A data delivery system will exist
  - All tools will be incorporated into NCAT

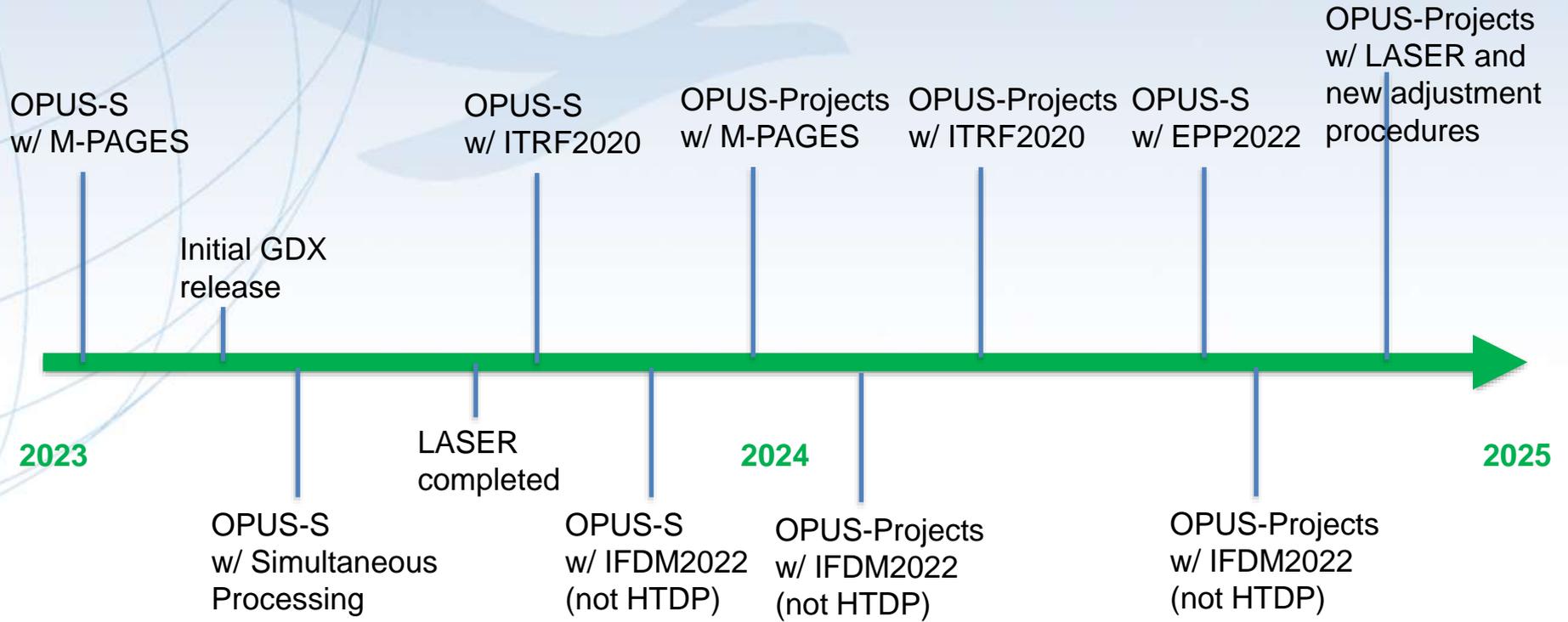
# The path to full roll-out: Frames



# The path to full roll-out: Geopotential



# The path to full roll-out: OPUS



# The path to full roll-out: Passive control

