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Implementing Geometric and Geophysical Datums for the United States in 2022 (Paper 7610)

Daniel R. Roman, Ph.D.

Session TS02G – Datum Definition

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REPLACING NAD 83 IN 2022

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Monday, 17 May 2015 1600-1730

FIG Working Week - Sofia, Bulgaria 17-21 May 2015

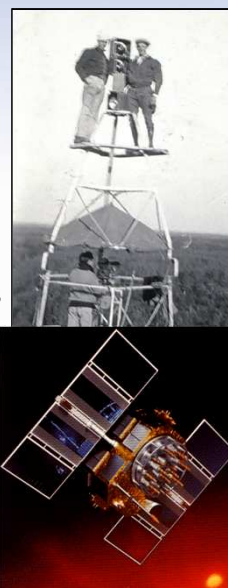
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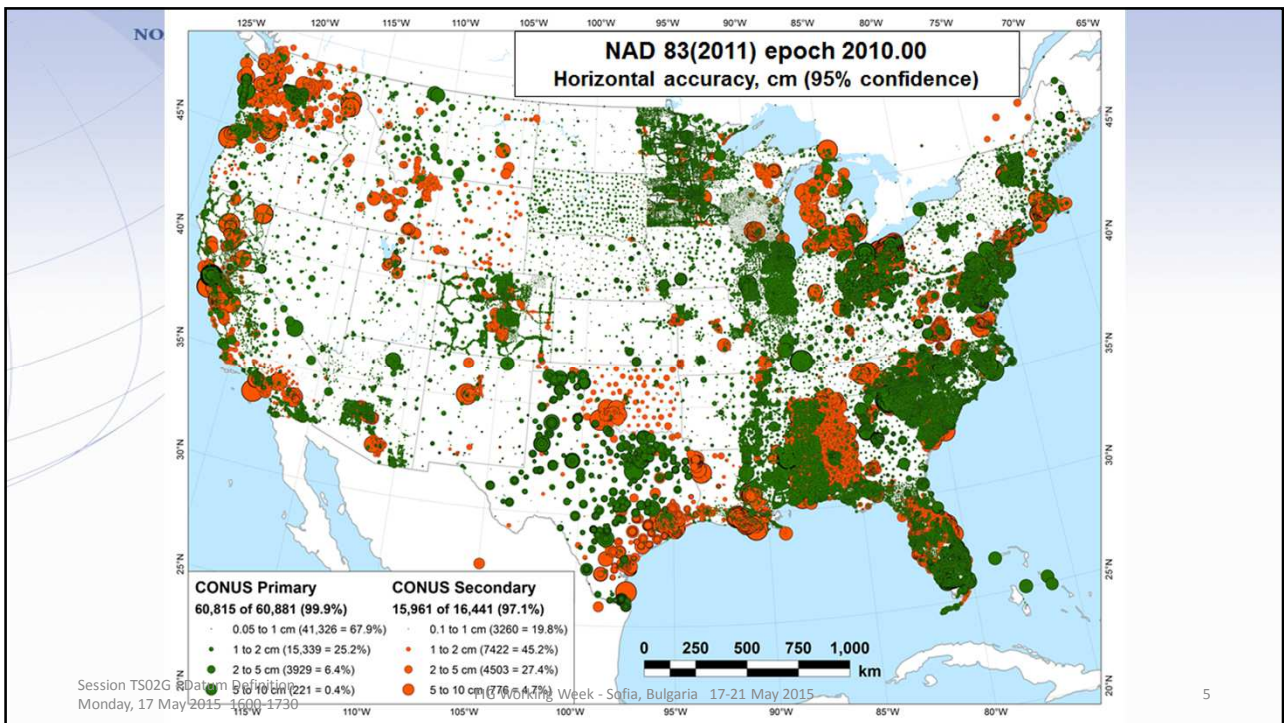
NAD 83 => Geometric Reference Frame

- Primary access shifts from bench marks to GNSS/OPUS
- Datum Offset w.r.t. IGS/IWGS84
- Bench marks tied to new reference frame and secondary
- Implementation in 2022

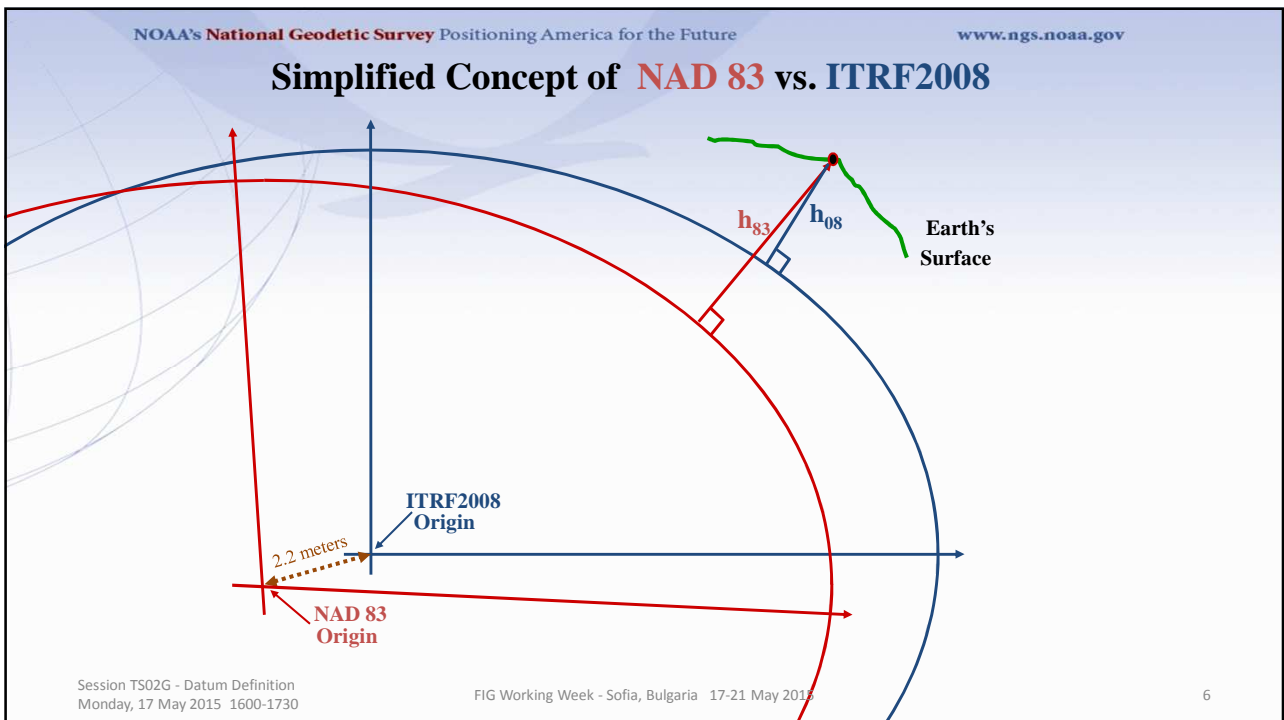
A brief history of NAD 83

- Original realization completed in 1986
 - Consisted (almost) entirely of classical (optical) observations
- “High Precision Geodetic Network” (HPGN) and “High Accuracy Reference Network” (HARN) realizations
 - Most done in 1990s, essentially state-by-state
 - GNSS based, with classical obs. incl. in adjustments
 - Did NOT use CORS as constraints
- National Re-Adjustment of 2007
 - NAD 83(CORS96) and (NSRS2007)
 - Simultaneous nationwide adjustment (GNSS only)
- ***New realization: NAD 83(2011) epoch 2010.00***





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How will the new datums affect you?

Approximate Ellipsoid Height Change

Ellipsoid Height (Meters)
High: 2 m
Low: -2 m

Tectonic Plate Boundaries

The **new geometric reference frame** will change latitude, longitude, and ellipsoid height in CONUS and AK between **1 and 2 meters**.

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CORS Network September 2014

400 km

Blue CORS sites Total 2035

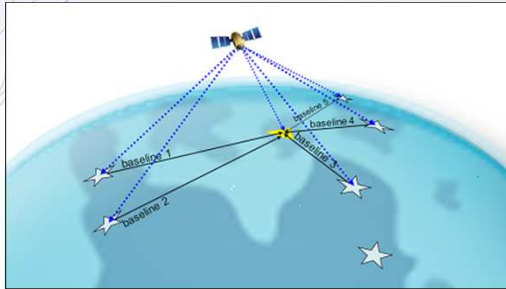
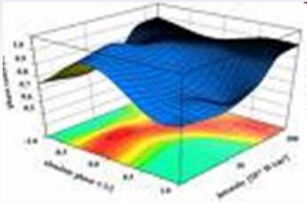
Alaska Hawaii

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Online Positioning User Service (OPUS)

<http://www.geodesy.noaa.gov/OPUS/>

Fast, easy, consistent access to NSRS

- Over 2.8 millions solutions processed since 2002
- Processed automatically on NGS computers
- Solution via email in minutes

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Implementation

- Foundation CORS tied to IGS solutions
- Stacking/Reprocessing yields consistent CORS coordinates
- Bench Marks are then adjusted to fit CORS control
- GNSS/OPUS derived positions supersede bench mark values
- Velocities applied to revert back to common epoch (2022.0)
- Effectively provides “fixed” plate & state plane coordinates
- Permits use for RTK positioning at current epoch

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REPLACING NAVD 88 IN 2022

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NAVD 88 => Geopotential Reference Frame

- Primary access shifts from bench marks to GNSS & geoid
- Datum Offset w.r.t. global gravity models from satellite data
- Bench marks tied to new reference frame and secondary
- Implementation in 2022

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How will the new datums affect you?

Approximate predicted change from NAVD 88 to new vertical datum
Predicted change estimated as NAVD 88 "zero" (datum) surface minus NGS gravimetric geoid

The new vertical (geopotential) datum will change heights
 50 cm on average with a 1m tilt towards the Pacific Northwest.

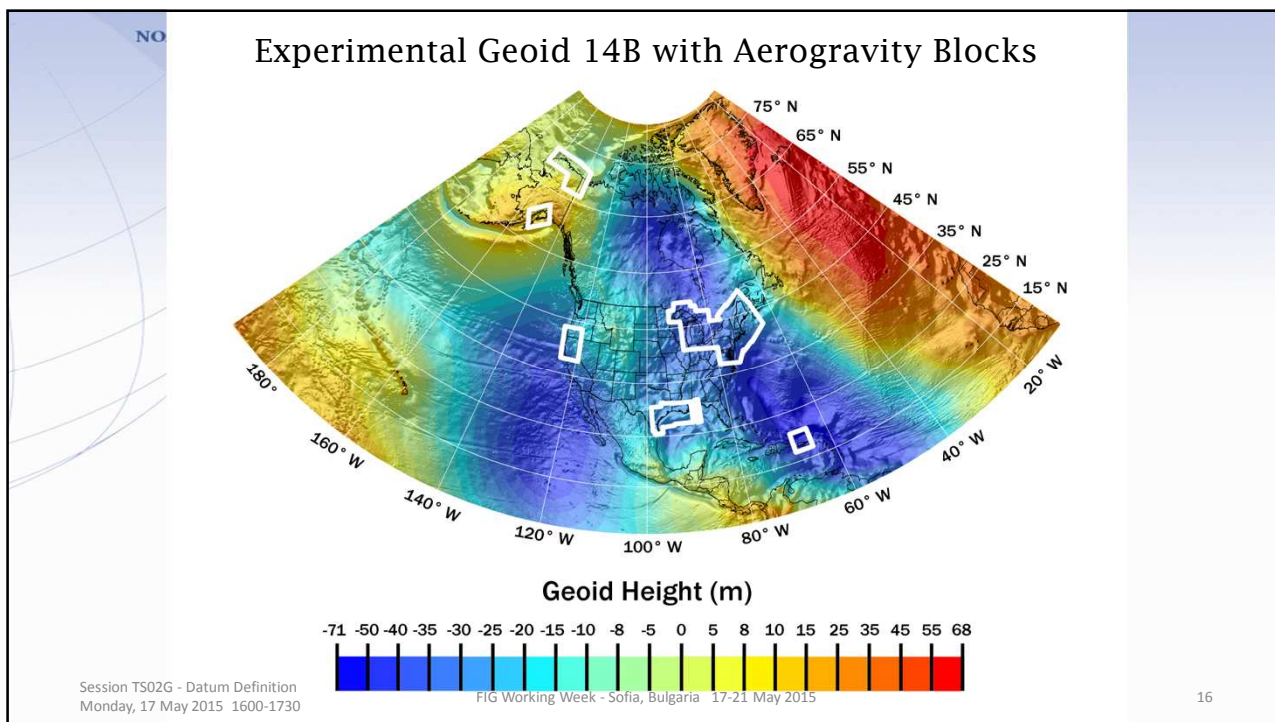
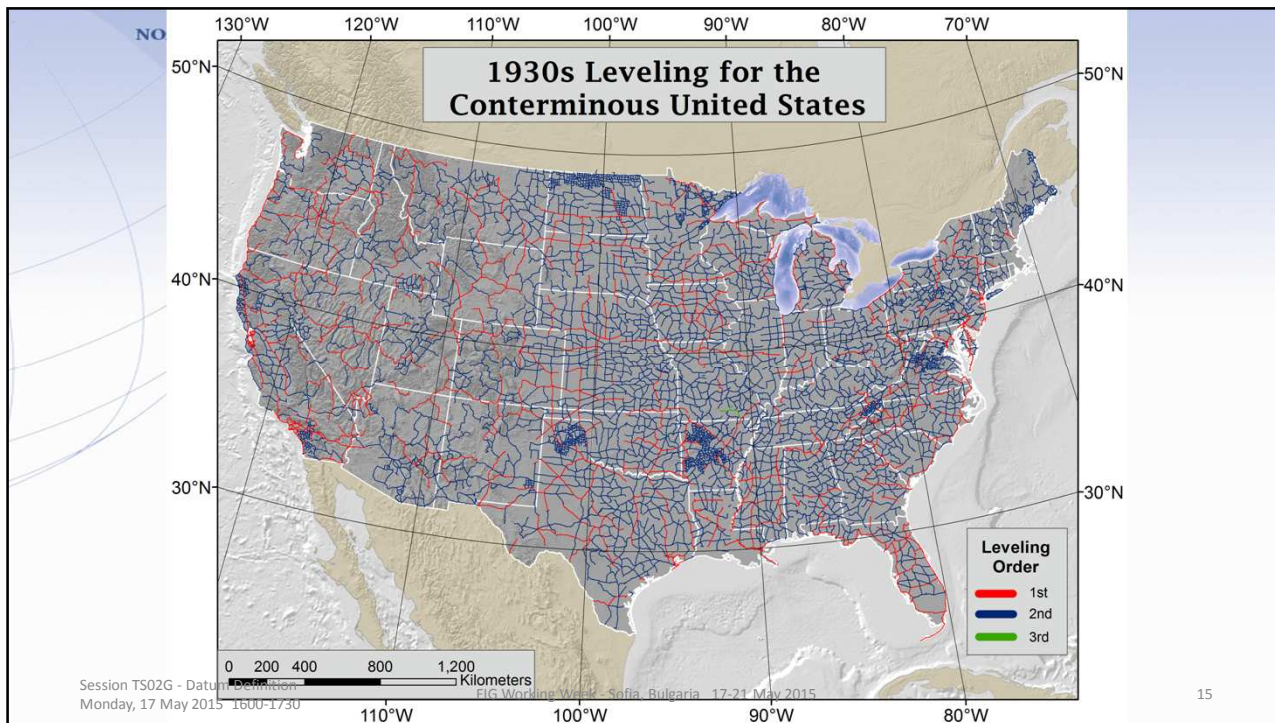
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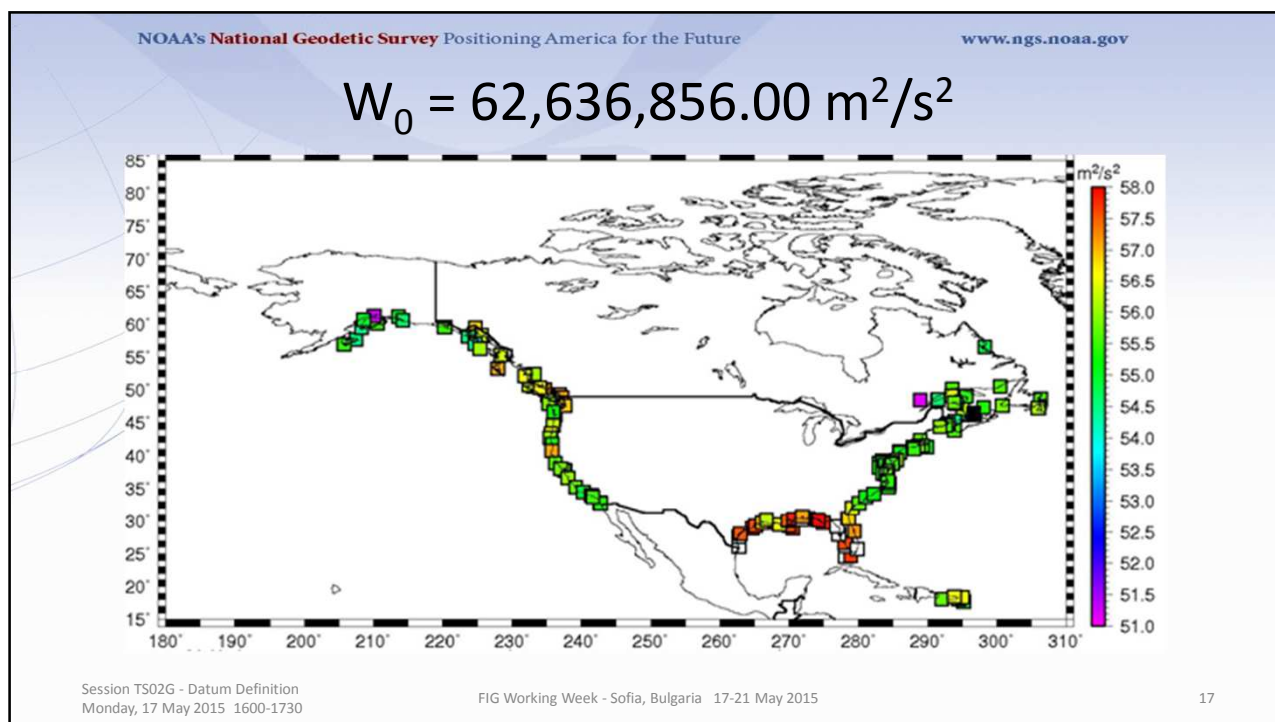
NGS National Leveling for the Conterminous United States

Leveling Order

- 1st
- 2nd
- 3rd

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Implementation

- Airborne gravity collection continues through 2020
- Airborne data normalized to satellite data
- Surface gravity normalized to satellite/airborne
- Spectrally merged data available either as grid or maybe SHM

- Geometric coordinates determined using GNSS/OPUS
- Gravimetric geoid model interpolated for conversion
- Geometric and geopotential velocities can be applied

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Summary

- NAD 83 and NAVD 88 both have inherent datum defects
- Both have inherent quality issues from age of data
- Both will be replaced by remote sensing derived data
- Physical heights will be derived from geometric and a geoid
- Geometric frame will follow on IGS solution closest to 2022
- Geopotential frames will incrementally finish in 2022
- Both new reference frames will provide global consistency

Daniel R. Roman, Ph.D.
Chief, Spatial Reference System Division/GRAV-D P.I.

National Geodetic Survey, NOS, NOAA
1315 East-West Highway, N/NGS2
Silver Spring MD 20910 U.S.A.

dan.roman@noaa.gov
+1-301-713-3200 (changing soon)
www.geodesy.noaa.gov

QUESTIONS?