

Demystifying the North American Reference Frames

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Product Management



**BLUE MARBLE
GEOGRAPHICS**

MIND THE GAP BETWEEN WORLD AND MAP

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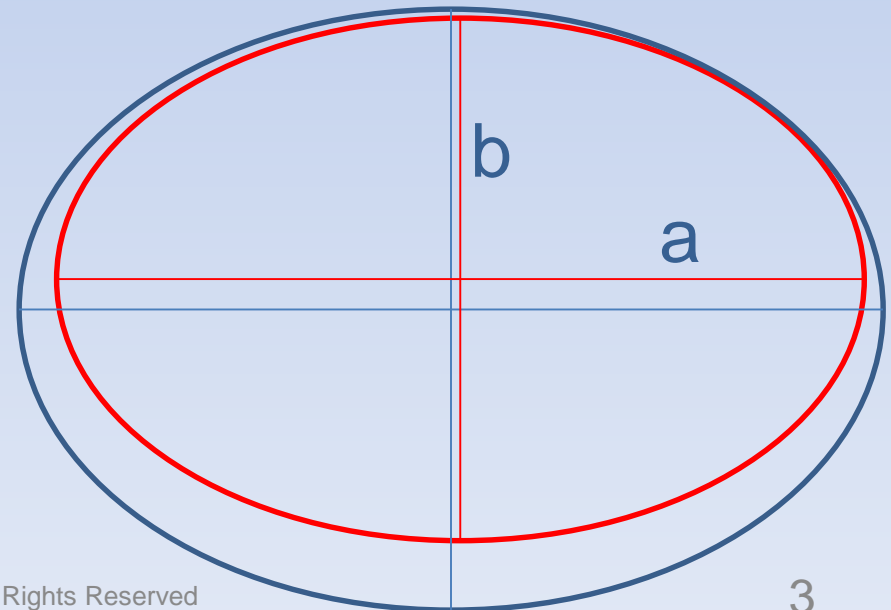
NAD27

- Basis for original State Plane Coordinate System
- Regional datum, centered on Continental US
- Uses Clarke's 1866 ellipsoid
 - $a = 6378206.4\text{m}$
 - $b = 6356583.8\text{m}$



NAD83(1986)

- Originally intended to be both Geocentric AND Plate-Fixed
- Base horizontal datum for State Plane 1983 series
- Uses GRS80 ellipsoid, physically larger than NAD27
 - $a = 6378137\text{m}$
 - $b = 6356752.31414036\text{m}$



NAD83 one datum, many names

- NAD83 (1986)
- NAD83 (1991)
- NAD83 (HARN)
- NAD83 (CORS96)
- NAD83 (CSRS1998)
- NAD83 (NSRS2007)
- NAD83 (2011)(MA11)(PA11)



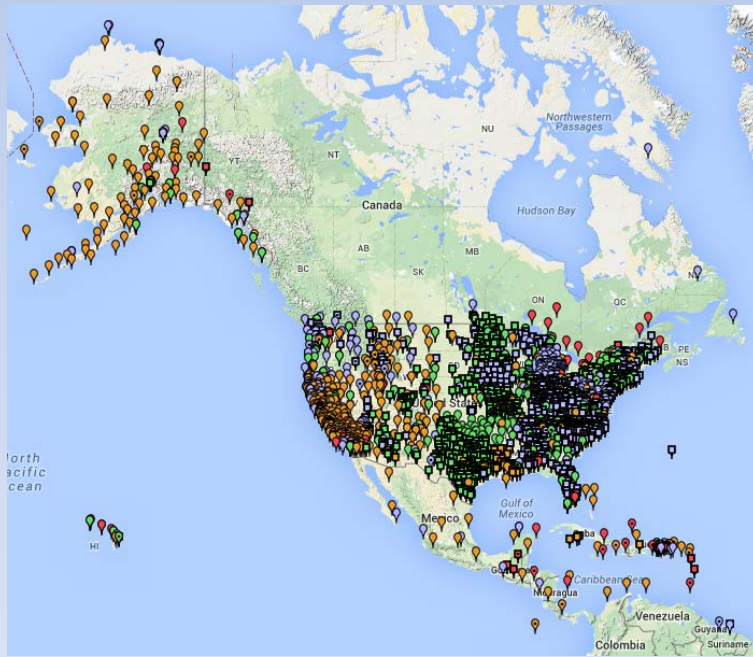
NAD83 (1991, HARN, HPGN)

- High Accuracy Reference Network
- High Precision Geodetic Network
- State by state rework based on a combination of active and passive marks
- Work ranged from 1986-1997



NAD83 (CORS96) - Time to Get Active

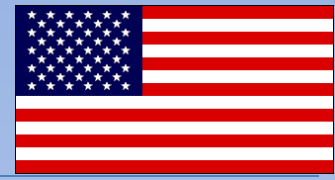
- Continuously Operating Reference Stations
- Enables postprocessing of GPS to put in NSRS



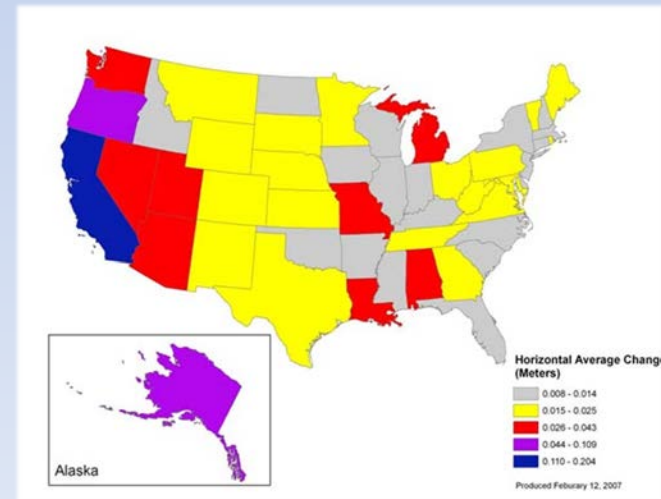


- Canadian Spatial Reference System
- CACS – Canadian Active Control System
 - Canada’s version of CORS in the US
- 3 common epochs
 - 1997.00
 - 2002.00
 - 2010.00

NAD83 (NSRS 2007)



- National Spatial Reference System
- Adjusted from CORS96 to new realization
- Shifts were originally promised, but not published
 - Differences were determined to be within the error threshold of transformation



NAD83 (2011) epoch 2010.00

- The current national survey standard
- Resulted from “Multi-Year CORS Solution”
- Adjusted locations of Passive controls based on GNSS from the CORS
- Will be superseded in 2022 if funded

Does my GNSS speak NAD?

- **No**
 - GNSS is geocentric, NAD isn't
- **Maybe**
 - WGS84 is pretty close to NAD83 (~2m)
- **Yes**
 - Higher end receivers can generate data to feed into a post processing tool to get NAD83(2011 or CSRS) back out



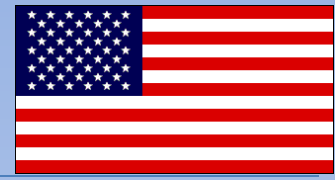
NAD83 and WGS84 – So much confusion

- They are not exactly the same
- They never have been
- They have similar ellipsoid dimensions
- NAD83 is NOT geocentric by about 2m
- NAD83 moves with the plates, WGS84 doesn't

ITRF & WGS84 – 10cm

- International Terrestrial Reference Frame
- ITRF1990 = WGS84 (1987, Transit, Original)
- ITRF1991 = WGS84(G730) at 1994.00
- ITRF1994 = WGS84(G873) at 1997.00
- ITRF2000 = WGS84(G1150) at 2002.00
- ITRF2008 = WGS84(G1674) at 2005.00

Tools – NGS Products



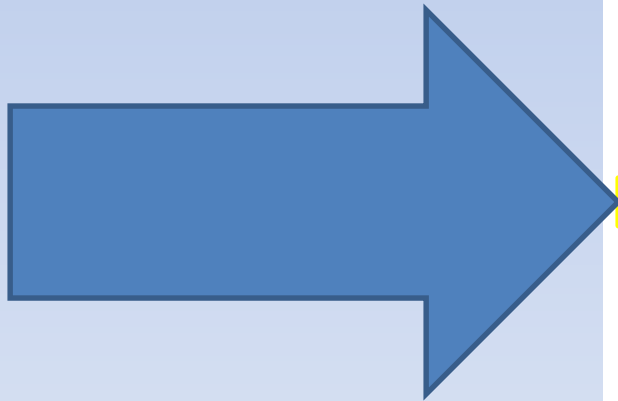
- NADCON – NAD27 to NAD83(1986)
- HTDP – Between NAD83 (all, sort of), WGS84(all), and ITRF (all)
- GEOCON – NAD83 HARN/2007/CORS96 to NAD83 (2011) epoch 2010.00
- OPUS – GPS reference frames to NAD83 (2011) epoch 2010.00



- NTV2 - National Transformation version 2
 - NAD27 to NAD83
- CSRS – PPP “Precise Point Positioning”
 - Takes in GPS data, outputs NAD83 or ITRF

NAD-X?

- NGS 10 year plan:
 - http://www.ngs.noaa.gov/web/news/Ten_Year_Plan_2013-2023.pdf



Objective 2-1: By 2022, reduce all definitional and access-related errors in the geometric reference frame to 1 centimeter when using 15 minutes of GNSS data.

Nickname: Replace NAD 83.

Description: The North American Datum of 1983 (NAD 83)—in both its definition, as well as the services NGS provides for its access—is in need of improvement. From the standpoint

NAD-X?

- Will not be called NAD_____
- Will likely be geocentric
- Will be a truly continental system
- Will likely coincide with ITRF at some epoch
- Will be GNSS compatible
- Will cause changes to State Plane CRS series

Get Prepared

Brand new website at NGS:

<http://geodesy.noaa.gov/datums/newdatums/NewDatums.shtml>

2015 Geospatial Summit:

<http://www.geodesy.noaa.gov/2015GeospatialSummit/>

Thanks!

Questions?

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