The Truth about WGS84

This begins with a simple statement of fact: "WGS84" is an ellipsoid.

Some people talk about surveying and mapping relative to WGS84 as a datum. This will connect you with publications that represent answers for those in doubt. People talk about what they think they know. Perhaps that includes this paper. Evaluate the information presented here to get closer to the truth about the datum and geodetic positions in the USA..

If WGS84 is ever used to define a datum it needs an identifier in much the same way that NAD83 needs a tag that tells us what realization of NAD83 is meant.

This link to an article makes reference to WGS84(G1150). It does not offer any transformation parameters for WGS84(G1150) nor a single clue how to transform coordinates to that or any other realization of WGS84. If calculus and analytic geometry class are too many decades in the past read past the numbers to understand the basic concepts.

http://www.ngs.noaa.gov/CORS/Articles/GPSTrans2.pdf

Remember when Selective Availability ended? Bill Strange, aka Mr. Geodesist, wrote an article at the time describing the relationship between WGS84(G873) and NAD83.

http://ecow.engr.wisc.edu/cgi-bin/get/cee/659/rodman/readings/diffbetwnad83andwgs84datumsoct2000.html

Dave Doyle offered some useful advice to use the NGS HTDP software to get approximations of some WGS84 coordinates:

WGS84(G1150) ≈ ITRF00

WGS84(G873) ≈ ITRF96

WGS84(G730) ≈ ITRF92

You can certainly argue that these various realizations of WGS 84 are not exactly equal to reference frames linked, but given that NGA has never developed such a tool it is probably the best estimate available.

Are you confused already? Please do not feel lonely about it. Visit this group of equally confused people.

http://www.cartotalk.com/lofiversion/index.php?t2859.html

Part of their problem is that they are testing with software and tools that are not official answers. No commercial product should be used without testing against a standard.

Corpscon is not a national standard. The NGS has disclaimed it in times past and does not offer it through their web page. All versions of Corpscon should be tested against the NGS Geodetic Toolkit. The NGA does not offer Corpscon either. It is offered by the US Army. It is probably perfect software but that will only be known after testing it against a standard.

http://crunch.tec.army.mil/software/corpscon/corpscon.html

If a contract requires WGS84 UTM coordinates and NAVD88 elevations all at the same time this presents even more challenges. There are some official answers from the NGA. Parts of the NGA web site are restricted access.

http://www1.nga.mil/ProductsServices/GeodesyGeophysics/Pages/default.aspx/geotrans/geotrans.html

You can even get the Geotrans software.

http://earth-info.nga.mil/GandG/geotrans/index.html

Read the documentation carefully. Is plus or minus two meters in the error budget? What if eight meter differences are found?

The NGA offers help with the EGM96 geoid model.

http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm96/intpt.html

They ask everyone to please view the readme page first. Please do. The orthometric height is not referenced to NAVD88. The geoid height is only appropriate for use with WGS84 ellipsoid heights.

Test the orthometric heights computed using ITRF00 ellipsoid heights and EGM96 against the orthometric heights computed using NAD83(CORS96) and the Geoid03 software using the NGS geodetic toolkit. Grab some OPUS reports and run the numbers. Do they both provide the NAVD88 orthometric height for the OPUS point?

What is the function of the NGA transformations? What is meant by "horse shoes and hand grenades"? Read all about it in their official publication.

http://www1.nga.mil/ProductsServices/GeodesyGeophysics/WorldGeodeticSystem/Related%20Documents/8358_1a.pdf

Dru Smith may seem contrary but the title of his paper tells most of what needs to be known.

http://www.ngs.noaa.gov/PUBS_LIB/EGM96_GEOID_PAPER/egm96_geoid_paper.html

Examine what the NGS has to say about geoid models on the web page at

http://www.ngs.noaa.gov/GEOID/

Look at the NGS transformation between ECEF coordinates and latitude, longitude, and ellipsoid height. What datum is offered? The clue is in GRS80, the reference ellipsoid for NAD83.

http://www.ngs.noaa.gov/TOOLS/XYZ/xyz.html

This article in the federal register seems to claim the ITRF and WGS84 are the same thing. Is this the truth? This is a very useful clue. Is there an official contrary argument?

http://www.ngs.noaa.gov/PUBS_LIB/FedRegister/FRdoc95-19408.pdf

A very nice person who worked for the NGA advised not to believe every single word in print. Their version of WGS84 is "close" to the ITRF. How close? That was not an answer she could offer. She also said what I have been told many times. Nobody, who does not have "a need to know", can have the precise WGS84 coordinates for anything.

The people who know the precise WGS84 coordinates for a point work with the DoD and they have "a need to know". Anybody outside that circle who claims to know the WGS84 coordinates for a point is probably wrong.

Test the NGA Geotrans software against the NGS geodetic toolkit for things like transformations between NAD83 and NAD27. How does that compare? Prove the truth! That will build confidence.

http://www.ngs.noaa.gov/TOOLS/

The ITRF00 coordinates may be close enough to satisfy some contract requirements for WGS84. Few would know the difference. That is what the FAA seems to have done for the WAAS. Is there an official answer about that? They are obligated by international agreement to provide corrections relative to WGS84 but the DoD is just as stubborn with the FAA as they are with everyone else outside the DoD. The FAA WAAS control stations were surveyed relative to the ITRF00 after having first been surveyed relative to NAD83(HARN).

Confidence that this is the truth is solid but an official answer about the datum for SBAS corrections has not been found. Field measurements indicate the SBAS is closer to the ITRF than to NAD83.

If a contract requires the use of WGS84 as a datum it should offer data sheets for control points related to WGS84. Test the data sheets against OPUS reports and decide about the relationship between WGS84(xxxx), NAD83(CORS96), and the ITRF00.

The exchange of digital geographic data is a modern day fact of life. Proper use of the digital map information depends on clear metadata that correctly identifies the map datum used. Map accuracy is enhanced when proper identification of the datum is part of the entire process.

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