**Comments on NM Geospatial Advisory Committee February Virtual Meeting**

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**The impact of using true 3-D can be beneficial to both spatial data users and to citizens of NM. (Is it possible that this opinion is contrary to the Holy Bible, Genesis Chapter 11, verses 1-9?)**

The NMGAC holds a virtual meeting on the second Tuesday of each month for 2 hours followed by a 30-minute technical presentation. The default topic of discussion this morning centered on "LIDAR and elevation." Various views were presented by many of the approximately 30 persons attending - a truly talented cross-section of spatial data users representing various disciplines.

The "poll" question was, 'how do you use LiDAR data related to elevation?' Admittedly, some people don't, but the discussion of applications was excellent.

When it came my turn to talk, I started out by noting that elevation is typically used either as orthometric height (pseudo 3-D) or ellipsoid height (true 3-D). Each application has legitimate reasons for existing but, regretfully, the difference between the two is "the elephant in the room." It seems that no one wants to acknowledge or discuss that difference.

As an advocate of using "a 3-D model for 3-D data" and promoter of the global spatial data model (GSDM), I referenced a recent proposal submitted to the National Institute of Science and Technology (NIST) to "standardize" a 3-D geospatial data model – see http://www.tru3d.xyz. As a follow-up, I promised to post additional comments on that web page to discuss the potential impact of true 3-D to NM spatial data users. These are the comments.

1. With modernization of the National Spatial Reference System (NSRS) the numbers representing elevation will be different – this would be an opportunity to "Go Metric." The numbers (metric or not) will represent:

    a. Pseudo 3-D based on orthometric heights.
    b. True 3-D based on ellipsoid heights.

2. Given that the numbers will be different, the argument is that true 3-D should be used because:

    a. The ellipsoid (as a reference for elevation) is easier to find (GNSS etc.) than is the geoid.
    b. The ellipsoid is more stable than the geoid. NGS acknowledges that the geoid moves.
    c. Other examples of basing practice on a mathematical model include:
        1. Equation of Time – the whole world uses Mean Solar Time rather than Solar Time.
        2. Polar motion – Scientists make corrections without asking the general population.
        3. Speed of light – imagine confusion if the constant for speed of light were changed.
        4. Relativity – Scientists apply principles of relativity to satellite signal transit time.

3. The argument is made that water must flow downhill. Yes, slope is given by pseudo 3-D.

    a. Slope can also be approximated using true 3-D. Corrections (rarely needed) are available.
        1. Dynamic heights are needed to compute hydraulic gradients for Great Lakes System.
        2. Gradients for lengthy (north/south) irrigation systems.
        3. Alignment of high-energy physics collider beams.
        4. Railroad sorting yards (by gravity) – such as the one in North Platte, Nebraska.

b. Incidental issue – corrections are based on the deflection-of-the-vertical (obtained from geoid height differences). The difference between geoid heights is more important that actual geoid heights – meaning corrections from one geoid model are very similar to those from another.

4. Various technologies are used to collect enormous quantities of spatial data.

    a. GNSS measures 3-D (on point). Both remotely, LiDAR measures distances to a target while photogrammetry measures angles to targets. Current software packages combine measurements to provide valuable spatial data sets. Question, are the delivered results:

        1. Pseudo 3-D?
        2. True 3-D?

    b. It is essential that the vendor and the client are in agreement as to the deliverable.

    c. Many applications (traditional) continue using pseudo 3-D while others (emerging) applications use true 3-D.

5. Impressive reasons exist for using both forms of spatial data. The aspiration in the proposal to NIST is that an independent third party can reliably identify current uses in each case and that, if appropriate, a well-thought-out approach can be developed for the way forward.

6. The benefits of standardization are espoused by some, but not necessarily by all. I take the position that we should plan for universal use of true 3-D.

## Yes, input from NM GAC should be included in those discussions!