Listing of Ideas for Formal "Simple" Paper on the GSDM

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On May 13, 2020, I sent (to selected persons) an improved DRAFT of a paper arguing that the GSDM is "adequate" as an alternative to low-distortion projections. The paragraphs following were included in the email message and include information on a still-to-be-written-paper covering the "simple" arguments for using the GSDM. This listing is quite informal but, along with information on "The Role of a Model," will be incorporated into a more formal paper listing the "simple" arguments for adopting the GSDM as an alternative to LDPs. This document contains several improvements to the May 13th memo.

The "final" draft of the first paper is posted at www.globalcogo.com/adequate.pdf while this informal (preliminary) paper is posted at www.globalcogo.com/simple.pdf.

As before, comments are welcome.

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Following is the email message of May 13, 2020
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All;

Attached is my "shelter-in-place" product. I sent the first draft out several weeks ago and got some excellent feedback. I hope this version is a bit better. But, better or not, I'm still open for improvements. I'm not sure yet where I should attempt to get it published – any suggestions?

Bear in mind that my goal and loyalty is to the end user. I consider each of you to know more about some part of the topic than I do and I am willing to learn from you. I'm not bucking for a promotion or for atta-boys. I desire to come up with something that helps enhance the surveying profession and our reputation of service within the professional arena.

In the "adequate" paper, I alluded to a second paper to be written on "being simple." My argument in the "simple" paper is biased to the GSDM and will address:

1. The equations for the GSDM are all included in the definition published in 1997. They are all in the public domain – no secrets. The most challenging part of the algorithm is converting from X/Y/Z to phi/lambda/h. That can be done with iteration or with any number of non-iterating methods already proven to work.

2. On the other hand, I will argue that map projections (and LDPs in particular) are at a much higher level of complexity because:

- Rightly or not, being conformal is over-rated. A conformal map was important to sailors so they could navigate port-to-port on a given direction – no longer needed.

- Scale at a point in any direction is not needed because the GSDM does not distort distances. Or one could say that scale is 1.000 in all directions at every point. Of course, this breaks down when carried to ridiculous lengths. That has to do with the evolving definition of horizontal distance.

- A definition of horizontal distance is no longer needed because the GSDM uses the 3-D spatial distance to establish a new point. Once a point is established, it is a slam dunk to compute any other geometrically defined distance. Most applications need or use a straight-line distance, chord, arc, spiral etc. They are all geometrically defined.

- Conformal mapping relies on various definitions of latitude – geodetic, rectifying, isometric, conformal etc. See Spec Pub 67, "Latitude Developments Connected with Geodesy and Cartography" and/or Spec Pub 251, "Conformal Projections in Geodesy and Cartography." For me, the mathematical complexity is brutal as I attempt to understand the Cauchy-Riemann equations and concepts of complex variable theory. I stand it awe of those who can handle same but cringe to think a person needs to understand such to build a software package for handling spatial/geospatial data.

- When I was an undergraduate, I did some work for Professor Berry on the Phi-Chi series. It seems the powers of eccentricity (8 in Spec Pub 67) were questioned – was that enough? We carried it to powers of 10. Honestly, probably not needed. Later, I came up with an alternating-sign series and compared results to iteration. Was it a waste of time to learn what I didn't need to know? Not really – the value and efficiency of iteration was confirmed.

- When I worked the summer of 1983 at NGS on transformation equations NAD 27 to NAD 83, the criterion was to be correct within 0.1 mm. I was provided an HP desktop computer (not a PC) with 12 significant digits. One of the first things I did was to show them that 0.1 mm was not possible with 12 significant digits. They let me stand in line to use the mainframe.

- When NOS NGS 5 was published, the statement is made that all transformations are assured within a mm – an entire magnitude relaxation. Current requirements for NAD 83 to 2022 stipulate transformations are to be within 0.01 mm. What is the justification for that? Will it be realized? Is it necessary? – not an issue with the GSDM.

- Years ago, logarithms were the "easiest" method of computation. Now more efficient methods are used. It is not that logarithms are defective or not rigorous – innovative persons found a way to use newer technology to make computations easier.

- In my experience with using the Michigan system at 800 feet. It was great and totally useful. But I found few others (surveyors/vendors/etc.) understood it. Yes, it could have been "forced" to work, but I believe it was the right decision to move the reference surface back to the ellipsoid. I see a parallel with the proliferation of LDPs. NGS appears to be doing a good job of keeping things organized and on-track. But I still question the need for 39 LDPs in Oregon.

- I see in the latest from POB that the arguments on the foot vs foot are still raging. I hope NGS exerts sufficient leadership to prevail in bringing that level of standardization to the use of geospatial/spatial data.

- I almost forgot – the GSDM includes the stochastic model for handling spatial data accuracy. That is a bonus whose benefits will become more and more apparent as time goes by.

- The ASCE Discussion of the Soler/Han article on “Rigorous Estimation of Local Accuracy Revisited” vindicates using the GSDM. See www.globalcogo.com/validation.pdf. That Discussion has been downloaded over 700 times since being posted in March 2019.

- The March 2020 article on “Spatial Data Accuracy Concepts” in POB raises the possibility of being precisely wrong with GPS. Could the same be said from using an LDP in an area with severe elevation differences?

- A final question/challenge might be academia/professional – what needs to happen with ABET, ASCE, NSPS, NCEES and the state licensing boards to fulfill the mandate of competent service to the public? Lots of challenges/opportunities for all.

I’ll be happy to engage in conversation/discussion on any/all of the above.