

White Paper
Assumptions Underlying Use of the 3-D Global Spatial Data Model (GSDM)
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I. Introduction

This white paper is written to clarify reasons for my positions and statements made with respect to definition of the global spatial data model (GSDM) and use of 3-D digital spatial data. I have learned much from many and I try to listen carefully to those having better insight. I am humbled by the patience of those willing to indulge my questions.

For me, science is the arrangement of knowledge in a logical order in which conclusions are consistent with beginning assumptions and subsequent observations. The process is iterative in that inconsistencies force a re-evaluation of a given thought process.

With regard to using 3-D digital spatial data, the basic assumption is that the center of mass of the Earth is the origin for geospatial data.

1. The functional model portion of the GSDM implements long-established rules of solid geometry in the context of the geocentric Earth-centered Earth-fixed (ECEF) reference system as defined by the U.S. DoD (WGS84) and verified compatible with the International Terrestrial Reference Frame (ITRF) as defined and observed by the global scientific community.
2. The stochastic model portion of the GSDM is built on fundamental error propagation concepts given by:

$$\Sigma_{YY} = J_{YX} \Sigma_{XX} J_{XY}^t \quad \text{where:}$$

Σ_{YY} = the covariance matrix of the computed result.

Σ_{XX} = the covariance matrix of the observations.

J_{YX} = Jacobian matrix of partial derivatives of result with respect to variables.

Legitimate reasons for avoiding use of the GSDM include changing the underlying assumption or finding inconsistencies in subsequent logical mathematical developments. The assumption and processes have both withstood careful examination by qualified professionals.

II. Use of 3-D digital spatial data has invaded many disciplines worldwide and human ingenuity has found many ways to use those data in a productive manner. Even so, the following constitute challenges faced by many spatial data users.

1. The younger generation less so, but accommodating the transition to digital 3-D will not necessarily come easy. See “Disruptive Innovation” written in December 2015 for consideration by surveying professional leaders. See - <http://www.globalcogo.com/DisruptiveInnovation.pdf>
2. Early personal experience (primarily from an analog perspective) for many is that spatial data are 2-dimensional for horizontal and 1-dimensional for vertical. Part of the educational challenge (for both academic and in practice) is (will be) to transition to a “big picture” view of 3-D digital spatial data. See <http://www.globalcogo.com/setepaper.pdf>

3. In 2011, the Western Federation of Professional Surveyors (WestFed) was discussing the dual challenges of becoming more relevant to constituent state society members and bolstering revenue for the organization. The following item was presented to the WestFed Board of Directors in January 2012 and contains specific recommendations for involvement in the larger spatial data user arena. Those recommendations remain largely relevant. <http://www.globalcogo.com/WestFed.pdf>
4. In March 2014 NOAA issued a Request for Information (RFI) asking the business community to assist in finding ways to capture more of the economic value inherent in the vast agency holding of spatial data. Apparently my response was considered naïve and inappropriate. It went nowhere. But, the overall issue of inter-operability and the potential benefits associated with standardization of a spatial data model cannot be overstated. See - <http://www.globalcogo.com/BIGDATA.pdf>
5. In February 2015, the Coalition of Geospatial Organizations (COGO) issued a Report Card on the U.S. National Spatial Data Infrastructure. A link to that report is:
www.globalcogo.com/2015COGO-report.pdf .

The COGO Report Card contains some important ramifications for the spatial data user community – including the surveying profession. Yours truly had an opportunity to comment on and to discuss some of those issues in September 2015 at the New Mexico Joint Annual Conference of the American Planning Association and the American Society of Civil Engineers in Las Cruces, New Mexico. A link to that presentation is:

<http://www.globalcogo.com/APA-ASCE-Spatial.pdf>

6. The Fifth Session of the United Nations Committee of Experts on Global Geospatial Information Management was held August 3-7, 2015 at the United Nations Headquarters in New York. A link to the relevant UN web site is http://ggim.un.org/ggim_committee.html

The United Nations subsequently published a document, “Future Trends in Geospatial Information Management” which describes challenges worldwide. I link to that document is:

<http://ggim.un.org/knowledgebase/KnowledgebaseArticle50444.aspx>

III. So what does all this have to do with the future of surveying?

Surveying is but a part of the overall spatial data user community. Boundary surveying is but a part of the overall practice of surveying. However, when it comes to providing competent professional services to society, surveying has an enormous contribution to make – and it goes far beyond running a data collection business or running lines on the ground. I am speaking of providing leadership in choosing models, writing standards/specifications/contracts, evaluating software tools, testing equipment, and, most importantly, solving problems for clients and providing risk management services - too much for one person to do but collectively with a vision, doable.

This information was compiled in response to discussions both at the NCEES Forum on “The future of surveying” held January 22, 2016, in San Diego and to the Executive Committee meeting of the ASCE Surveying & Geomatics Division February 19 & 20, 2016 in Corvallis, Oregon. Both groups have a vested interest in successful professional practice on many levels. The information provided herein is intended to be used beneficially to the extent possible by both groups. Of course, others not associated with NCEES or with ASCE can also benefit from this information.

Summary of NCEES meeting: <http://www.globalcogo.com/FutureNCEES.pdf>