

Modern Surveying, 3-D and the Global Spatial Data Model - GSDM

**El Paso Seminar
TSPS Paso Del Norte Chapter 17
NMPS Southern Rio Grande Chapter
Camino Real Hotel
September 28, 2013**

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Proposed Schedule:

- I. Introduction and background**
- II. Break**
- III. Identifying the challenges**
- IV. Break**
- V. Solutions and applications**
- VI. Evaluation**

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Presenter: Earl F. Burkholder, PS, PE, F.ASCE

- **Served as NMPS President 2009.**
- **Retired from NMSU Surveying Engineering in July 2010.**
- **Has been involved in ABET Accreditation since 1983.**
- **Wrote book, The 3-D Global Spatial Data Model (GSDM).**
- **Is currently Past Chair – ASCE Geomatics Division EXCOM.**
- **Current focus is considerations of Spatial Data Accuracy.**
- **Is also undergraduate student in Computer Science at NMSU.**
- **Promotes use of 3-D COGO and error propagation software.**
- **Is available for consulting services.**

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Big picture view of “modern” challenges in surveying

- **Technology and the electronic revolution**
 - **Computers**
 - **Measuring systems**
 - **Characteristics of 3-D geospatial data**
- **Spatial data models**
 - **Local easting, northing, up and map projections**
 - **Geodetic latitude/longitude/height**
 - **Geocentric X/Y/Z**
- **Geographic Information Systems (GIS)**
- **Migration of data to “the cloud.”**
- **LiDAR & Laser Scanning - BIM**
- **Satellite imagery**

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Resources – incomplete list:

- Global COGO, Inc. web site – www.globalcogo.com
- Book: “The 3-D Global Spatial Data Model – GSDM”
(most material in book is available on Global COGO web site)
- Journals – ASCE, ASPRS, Survey Review, and SALIS
- Trade magazines – Good source of info, Read carefully
 - POB
 - American Surveyor
 - Professional Surveyor
 - GIM International
 - Apogeo Spatial

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Time for a break; take 10 - 15 minutes!

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Issues: Ask audience which to discuss

- 1. What is meant by “modern” 3-D Surveying?**
- 2. What are the “modern” tools being used by surveyors?**
- 3. How much of our practice involves boundaries?**
- 4. How does the surveyor interact with other professionals?**
- 5. What software is needed to support modern practice?**
- 6. What educational focus should be emphasized?**
- 7. What other disciplines use spatial data?**
- 8. Are spatial data accuracy standards needed/important?**
- 9. What is the 3-D global spatial data model – GSDM?**
- 10. How can using the GSDM benefit my practice?**

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What are the challenges associated with -

- **Running a business - projects?**
- **Weather and access to control - constraints and givens?**
- **Equipment – matching the equipment to the task.**
- **Clients – are you selling to the right market?**
- **Software – does your software do what you want done?**
- **Business environment – sole, partnership, corporate, agency?**
- **Finding/hiring the right help?**
- **Professional involvement**
 - **Contributions?**
 - **Benefits?**

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Typical survey practice

- **Local stand-alone projects:**
 - Measure distances, angles, elevations, etc.
 - Computations typically flat-earth 2-D geometry
 - Latitudes/departures/coordinates/elevations
 - Deliver and/or record survey plat.
- **Raise-the-bar projects:**
 - Measurements with GPS, LiDAR, or photogrammetry
 - Computations involve both horizontal and vertical
 - State plane coordinates and elevations
 - Product delivered in an electronic file.

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Challenges associated with modern practice

- Which datum should I use?
- Which map projection is appropriate – SPC, UTM, LDP?
- How do I handle difference between grid and ground?
- What is the basis of “north”?
- Who cares if I use survey foot or International foot?
- How can I protect my investment without giving it away?
- What is risk management and how can I use it well?
- Who uses relative data and who uses absolute data?

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Spatial data are used by:

- Surveyors – boundaries and other
- Engineers – civil infrastructure
- Photogrammetrists – mapping
- Architects – BIM etc
- Tax/revenue – GIS
- Utilities – Plant siting ROW
- Transportation
 - Highways/railroads
 - Ocean going vessels
 - Aerospace
- Geographers – demographic/economic studies
- Summary . . . <http://www.globalcogo.com/DM002.pdf>

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Time for a break; take 10 - 15 minutes!

Problem solving

- Traditional outline <http://www.globalcogo.com/GSDMI.pdf>
- Interactive outline <http://www.globalcogo.com/GSDMIII.pdf>
- What assumptions need to be challenged?
- Who determines what we do in our practice?
- Offer proof the earth is flat – what is fallacy?
- Assume single origin for 3-D data.
- Build model for spatial data using geometrical elements.
- Standard procedures for geometry and error propagation.
- Can be used by all spatial data disciplines worldwide.
- Supports derivative “specialized” uses and provides total flexibility to all users.

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Details of the global spatial data model (GSDM)

- Defined at <http://www.globalcogo.com/gsdmdefn.pdf>
- Many articles at www.globalcogo.com/refbyefb.html
- 3-D diagram at <http://www.globalcogo.com/3D-diag.pdf>
(and coordinate systems)
- Equations at <http://www.globalcogo.com/ionpaper.pdf>
- Example project www.globalcogo.com/nmsunet1.pdf
- 2-D example <http://www.globalcogo.com/3DGPS.pdf>
- Spatial data accuracy <http://www.globalcogo.com/accuracy.pdf>
- LDP vs GSDM <http://www.globalcogo.com/LDPvsGSDM.pdf>
- Future of Surveying <http://www.globalcogo.com/WestFed.pdf>

Solutions

Consequences of using the GSDM

- No projections, scale factors, elevation factors, zone constants.
- Preserves geo-referencing via ECEF X/Y/Z in data base.
- Rules for flat-earth latitude/departures remain valid/usable.
- Elevation is a derived quantity – geoid modeling minimized.
- True north is always readily available.

Exercises

- Posted at www.globalcogo.com/TSPS2013.html
- Spreadsheet software available by link on site.
- Burkholder will answer email questions as appropriate. Try me!

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End!

Don't Forget Evaluation!