

Résumé - Earl F. Burkholder, PS, PE

Current: NMSU Emeritus Faculty – retired 7/1/2010 President, Global COGO, Inc.
(Dec. 2022) Surveying Engineering Program P.O. Box 3162
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Education: University of Michigan: BS Civil Engineering, – graduated “cum laude” 1973.
Purdue University: MS Civil Engineering (Geodesy), 1980.
University of Maine: (no degree) Study applications of global positioning systems (GPS) to surveying while on sabbatical leave from Oregon Tech during the 1990-91 academic year.
On sabbatical from NMSU 2005-06 to finish writing a book, *The 3-D Global Spatial Data Model (GSDM)*. The book was published by CRC Press in April 2008.

Registration: State of Michigan: Professional Surveyor '74 to '82, Professional Engineer '79 to 2003.
State of Oregon: Professional Land Surveyor & Professional Engineer 1981 to 1997.
State of Ohio: Professional Surveyor and Professional Engineer '96 to 2004.
State of New Mexico: Professional Surveyor and Professional Engineer since 2000.

Experience:

Since retiring from teaching in July 2010, he has been involved in promoting use of the global spatial data model (GSDM). A summary of recent activities is available at www.globalcogo.com/News.html. The 2nd Edition of “The 3-D Global Spatial Data Model: Principles & Applications” was published by CRC Press in 2017, see [or use Google search](#). In December 2016 he presented a poster session at the AGU Fall Meeting in San Francisco on using the GSDM on the 2022 datum – see www.globalcogo.com/poster.pdf. In 2011/12 he served as Chair of the American Society of Civil Engineers (ASCE) Geomatics Division (GMD) EXCOM. The GMD is now part of the Utility Engineering and Surveying Institute (UESI), Surveying and Geomatics Division (SGD).

Before retiring, he held an appointment as an Associate Professor at NMSU and taught 14 different courses at NMSU including Surveying Fundamentals; Advanced Surveying for Civil Engineers; Fundamental Concepts for GPS, Spatial Data Concepts and Models; Introduction to Photogrammetry; Construction Surveying; Field Surveying Techniques; Computer Applications to Surveying; Geodesy; Introduction to Satellite Geodesy (GPS surveying); U.S. Public Land Survey System Boundaries; Introduction to Survey Measurement, Analysis & Adjustment (statistics); Advanced Survey Measurement, Analysis, and Adjustment (least squares); Advanced Topics in Mapping Science (map projections); and Senior Seminar. He served as Faculty Advisor for the ACMS/NMPS Student Chapter from 2001 to 2007, on several College of Engineering Grade Appeal Committees (three times as Chair), two departmental search committees, and on the NMSU College of Engineering Dean Search Committee which culminated in the selection of Dean Castillo in 2004.

He was self-employed as a consultant from 1993 to August 1998 and offered services related to use of GPS data and Geographic Information Systems (GIS's). During that time he pulled together concepts from various disciplines to define the Global Spatial Data Model (GSDM) which utilizes a 3-dimensional BURKORD® database. The GSDM concepts are described in various papers and summarized in a [report](#) prepared for the Southeastern Wisconsin Regional Planning Commission, Waukesha, WI, and published in 1997. In 2010 he completed a comprehensive report for the Commission to establish bi-directional transformations between old (2D/1D) datums and the new NSRS (2007) 3-D datum. That [report](#) was published in May 2010.

He taught upper division surveying classes at the Oregon Institute of Technology (OIT) from September 1980 to December 1993. Those courses included geodesy, astronomy, control surveying, state plane

coordinates, least squares adjustment, computer applications to surveying, instrumentation, introduction to GIS, and global positioning system (GPS) surveying. In addition to serving several years as Surveying Program Coordinator, other administrative activities at OIT included service on the Faculty Senate, the institutional Curriculum Planning Commission, and (as a Full Professor) on the OIT Engineering Technology Division Tenure Review Committee – one term as Chair.

From 1973 to 1978 he was employed by Commonwealth Associates, Inc., Jackson, Michigan, as an Assistant Engineer and was assigned to the Surveying Section of the Transmission Line Engineering Division. At Commonwealth, he became a Project Manager and participated as a member of multi-disciplinary teams in many different engineering projects located throughout the USA, plus one in South America, and a 1,000 km power line project in Iran (while the Shah was in office).

Awards:

- In 1986 he was presented the “Surveyor of the Year Award” by the Professional Land Surveyors of Oregon (PLSO).
- In 2005 he was elected a “Fellow” of the American Society of Civil Engineers.
- The North American Surveying Educators Conference presented him a plaque in July 2007 for “his great contributions to Surveying & Mapping education and practice.”
- He was presented the “2010 Surveying & Mapping Award” by the Geomatics Division of the American Society of Civil Engineers at their Annual Meeting in Las Vegas, Nevada.
- In March, 2013, the New Mexico Professional Surveyors (NMPS) presented Burkholder a “Life Time Achievement Award” at their Annual Meeting in Albuquerque, NM.
- He was honored as 2014 Alumnus of the Year for the 50th reunion of the Class of ’64 of the Eastern Mennonite High School of Harrisonburg, Virginia. See <http://www.globalcogo.com/awards.html>.
- It is not an award, but he contributed to and was listed as a “Subject Matter Expert,” in the World Geospatial Industry Council (WGIC) Policy Report: 2022-01, “Spatial Digital Twins: Global Status, Opportunities, and the Way Forward.”
<https://wgicouncil.org/publication/reports/download-the-wgic-spatial-digital-twins-report/>

Professional Activities:

Current activities focus on highlighting the importance of using a 3-D model for 3-D data in anticipation of the Modernization of the National Spatial Reference System (NSRS). It appears that a huge challenge is addressing the difference between true 3-D and pseudo 3-D, referred to as “the elephant in the room.” www.globalcogo.com/true-versus-pseudo.html.

Established practice in the United States uses separate horizontal and vertical datums. A better model will be both adequate and simple as described at <http://www.globalcogo.com/role.html>. The convergence of abstraction/technology/policy/practice is discussed at www.globalcogo.com/abstraction-1.pdf.

In August 2018 he submitted a response to the NGS Federal Register Notice regarding the state plane coordinate system of 2022 and encouraged the NGS to consider an integrated 3-D spatial data model as an option to the traditional 2-D map projection model – see www.globalcogo.com/NewDatum2022.pdf.

In January 2016 he was asked to represent the American Association for Geodetic Surveying at a “Summit” on “The Future of Surveying” hosted by the National Council of Examiners for Engineering & Surveying in San Diego January 22, 2016. Prior to the meeting he prepared a short paper on [Disruptive Innovation](http://www.globalcogo.com/future.html) for consideration by Summit attendees. Also see www.globalcogo.com/future.html.

Height Modernization: Height modernization is a formal program of the National Geodetic Survey (NGS) in which the global positioning system (GPS) and other new technologies are being implemented to establish reliable elevations on bench marks. While on sabbatical leave in 2005-2006, he started

working to bring height modernization to New Mexico. Working with surveying and engineering professionals, local spatial data users and others, he was able to bring NGS professionals to New Mexico to present two forums (one in Las Cruces and one in Albuquerque) on the details of Height Modernization. Since then he served as Co-Chair (along with Garry Nielsen of the NM DOT) of the Height Modernization Working Group working in conjunction with professionals throughout the state to bring Height Modernization to New Mexico. A proposal submitted jointly with the Texas Spatial Reference Center was approved effective 10/01/2008. Various outreach activities and a digital leveling workshop were supported as part of that joint project and a continuously operating reference station (CORS) was established at NMSU.

ASCE: In 2006 he was invited to be a member of the ASCE Geomatics Division (GMD) Executive Committee and in February 2007 he was named Chair of the GMD Education Committee. As Chair of the Education Committee, he organized a panel discussion on the Surveying Criteria for EAC ABET accredited surveying engineering programs at the 2007 North American Surveying & Mapping Educators Conference in Big Rapids, Michigan. He also represented ASCE GMD at the ACSM meeting of the Curriculum, Accreditation, Registration, and Education (CARE) Committee meeting in Spokane, Washington, March 8, 2008. He served as Secretary to the GMD of ASCE 2008 to 2011 before being named Chair of the GMD effective October 1, 2011 for a 1-year term. Prior ASCE Committee service included Geodetic Surveying Committee (Chairman 1985 & 1986), Education & Professional Practice Committee, Land Surveying Committee (1992-1994), and the Engineering Surveying Committee (1992-1996).

He served as Chair of the ACSM Education Committee from 2000 to 2003.

Accreditation: From 1990 to the present he has served as a Surveying Program Evaluator for the Accreditation Board for Engineering & Technology (ABET). He was a member of Applied Science Accreditation Commission (ASAC – formerly the Related Accreditation Commission) 1994-1998, on the ASAC Executive Committee 1998-2002, and Chair of the ASAC 2000-2001.

Editor: He served two 4-years terms, 1985 to 1989 and 1992 to 1996, as Editor of the *Journal of Surveying Engineering*, a refereed scholarly journal published by the American Society of Civil Engineers, Reston, VA. In 2007 he was asked to serve as the Review Editor for a paper, “On Geometric Combination of Multiple Terrestrial Network Solutions” for the *Journal of Surveying Engineering* because the current Editor was a co-author of the paper.

NSF involvement: In the late 1980’s he served as a reviewer for the National Science Foundation on two occasions for their Laboratory Improvement Grant Program. He also served as PI on two separate NSF grants – one was curriculum modification, the other was laboratory equipment improvement.

Peer Review: He has reviewed technical papers for the *Journal of the Urban and Regional Information Systems Association*, for the American Congress on Surveying & Mapping and their *Journal of Surveying and Land Information Systems*, and for the American Society of Civil Engineers’ *Journal of Surveying Engineering*. Since 1994 he has reviewed five separate proposals for the Research Grants Council of Hong Kong (the most recent in 2003 and again in 2004). In 2007, he reviewed an article “Official GNSS-Derived Orthometric Height Control Network” for *Surveying & Land Information Science*, Dr. Steve Frank, Editor, and in March 2008, he reviewed an article, “Towards Dynamic Coastal Land-Use Planning Using Geospatial Technology: Conceptual Design of a Collaborative Web-based GIS,” for *Technology Interface*, Jeff Beasley, Editor. In October 2014 he reviewed “High Resolution Mapping with Unmanned Aerial Systems (UAS)” for *Surveying & Land Information Science* – Charles Ghilani, Editor.

Chairman; 1989 to 1991; ASCE/ACSM/ASPRS Joint Committee - Definition of Terms Project to compile the Glossary of The Mapping Sciences published August, 1994.

Memberships; American Society of Civil Engineers, American Association of Geodetic Surveyors, National Society of Professional Surveyors, American Society of Photogrammetry & Remote Sensing, American Geophysical Union, Institute of Navigation, and New Mexico Professional Surveyors.

New Mexico Professional Surveyors (NMPS): Served as Secretary for Southern Rio Grande Chapter NMPS 1999-2002. Named Director on NMPS Board of Directors by the local chapter for 2004 and 2005. During 2006 he was President of the Southern Rio Grande Chapter NMPS and in 2007 he was Vice President of NMPS. During 2008 he served as President Elect and as NMPS President during 2009. 2011 to 2014 he served as 1 of 2 NMPS Delegates to the Western Federation of Professional Surveyors.

Seminars: He presented numerous seminars throughout the United States prior to joining NMSU. The following is a summary of seminars presented since joining NMSU in August 1998.

1. 1-day:	Oklahoma City	Oct 1998	Geodesy for Surveyors
2. 1-day:	Oklahoma City	Oct 1998	Integrating GPS & Terrestrial Survey Data
3. 1-day:	Portland, OR	May 1999	Geodesy, Photogrammetric Mapping & the GSDM
4. 1-day:	El Paso, TX	Oct 1999	Bringing GPS & Positional Tolerance into the Same Arena
5. 1-day:	Albuquerque	Feb 2000	Geodesy for Surveyors
6. 1-day:	Albuquerque	Feb 2000	Integrating GPS & Terrestrial Survey Data
7. ½ day:	Providence, RI	Dec 2000	Geodesy, Photogrammetric Mapping & the GSDM
8. 1-day:	St. Louis, MO	Apr 2001	Geodesy, Photogrammetric Mapping & the GSDM
9. 1-day:	Rochester NY	May 2001	Integrating GPS & Terrestrial Survey Data
10. 1-day:	Wash. D.C.	Apr 2002	Geodesy, Photogrammetric Mapping & the GSDM
11. 1-day:	Denver, CO	May 2004	A GSDM for the Digital Revolution
12. 1-day:	Ruidoso, NM	Aug 2005	Integrating GPS & Terrestrial Survey Data
13. 4-hr:	Verona, NY	Jan 2006	Using GPS for Reconnaissance in Boundary Surveying
14. 4-hr:	Verona, NY	Jan 2006	GPS Data Processing and Computations
15. 1-day:	Boise, ID	Mar 2006	The Impact of the Digital Revolution on Surveying
16. 1-day:	Las Cruces, NM	Dec 2009	3-D Global Spatial Data Model
17. 4-hr:	SPAR 2011	Mar 2011	3-D Global Spatial Data Model
18. 4-hr:	SPAR 2012	Mar 2012	3-D Global Spatial Data Model
19. 4-hr:	TSPS Surv.	Sept 2013	Participating in the Future of Surveying: 3-D GSDM
20. 4-hr:	Denver, CO	Feb 2015	Datums, Map Projections, and Coordinate Systems
21. 4-hr:	Las Cruces, NM	April 2015	Datums, Coordinate Systems, & Low Distortion Projections

Presentations:

- “Digital Twins and the Elephant in the Room,” presented virtually to the Surveying & Geomatics Educators Society (SaGES) Conference August 3, 2022. www.globalcogo.com/sages2022.pdf.
- “Geospatial Data: Convergence of abstraction/technology/policy/practice,” presented virtually November 9, 2021, to the New Mexico Geospatial Advisory Committee meeting. www.globalcogo.com/abstraction-1.pdf.
- “COGO Report Card” and “NGS 2022 Datum’s” presented March 2019 at the New Mexico Professional Surveyors Annual Conference, Santa Fe, New Mexico. See www.globalcogo.com/ReportCard.pdf and www.globalcogo.com/Datums2022.pdf.
- “Modern Uses of 3-D Digital Spatial Data” presented to a meeting of the High Tech Consortium of Southern New Mexico, Las Cruces, NM, www.globalcogo.com/HTC-October-2017.pdf.
- “Opportunity for Surveying Professionals to be Leaders in the Spatial Data Community,” presented July 2017, SaGES Conference, Corvallis, Oregon www.globalcogo.com/EFB-SaGES-GSDM.pdf.

- “Concepts of Spatial Data Accuracy Need Our Attention” presented July 2017, SaGES Conference, Corvallis, Oregon, www.globalcogo.com/EFB-SaGES-ALTA-NSPS.pdf
- “The Digital Revolution Bring with it a Better Model for 3-D Digital Spatial Data” presented December 13, 2016 at the Fall Meeting of the American Geophysical Union (AGU) in San Francisco, CA. see www.globalcogo.com/poster.pdf.
- “Civil Engineering, Planning, and the Spatial Data Infrastructure,” presented at the Joint Annual Conference of the New Mexico Section of American Planning Association and the New Mexico Branch of the American Society of Civil Engineers (APA/ASCE) September, 2015. www.globalcogo.com/APA-ASCE-Spatial.pdf.
- “Comments on and Discussion of the COGO Spatial Data Infrastructure Report Card,” ASCE Southern New Mexico Branch meeting, Las Cruces, NM July 8, 2015. www.globalcogo.com/ASCE-COGO-Rpt.pdf
- “Underground (Well) Mapping Re-visited” to the ASCE Shale Energy Engineering Conference, July 21-23, 2014 in Pittsburg, PA. globalcogo.com/underground-mapping.pdf
- “The 3-D Global Spatial Data Model (GSDM) Supports Modern Civil Engineering Practice and Education,” was presented at the 2012 International Conference on Computing in Civil Engineering in Clearwater Beach, Florida, on June 22, 2012. www.globalcogo.com/ASCE3D2012.pdf
- “Spatial Data Considerations for Civil Engineers” was presented at the ASCE Texas Fall Meeting in El Paso, Texas, October 6-9, 2010. www.globalcogo.com/spatialce.pdf.

President’s Columns: While serving as President of New Mexico Professional Surveyors during 2009, he authored a series of columns labeled “President’s Column.” A compilation of all six articles is posted at www.globalcogo.com/pcolumns.pdf. He continues writing for the NMPS Benchmarks Newsletter.

A partial listing of other Publications following. For a more complete list, see the following link - www.globalcogo.com/refbyefb.html

34. Burkholder’s Discussion of “Rigorous Estimation of Local Accuracies Revisited” by T. Soler and J. Han was published in the May 2019 issue of the ASCE Journal of Surveying Engineering. See - www.globalcogo.com/validation.pdf.
33. “Horizontal Distance Options” was not accepted for formal publication. But it is on file with the U.S. Copyright Office, Washington, D.C. – see www.globalcogo.com/HD-Options.pdf. December 2018.
32. “3D Geodetic Inverse,” Surveying and Land Information Systems, May 2016, Vol. 75, No.1.
31. “Using the Global Spatial Data Model to Compute Combined Factors,” ASCE Journal of Surveying Engineering, 06016001-1, November 2016, Vol. 142. No.4.
30. “Comparison of Geodetic, State Plane, and Geocentric Computational Models,” Surveying and Land Information Science, Vol. 74, No. 2, pp 53-59.
29. “Contrasting a Low Distortion Projection (LDP) With the Global Spatial Data Model (GSDM),” see, <http://www.globalcogo.com/LDPvsGSDM.pdf>, January, 2012.

28. "The Digital Revolution – Whither Now?," May 2006, www.globalcogo.com/Digital_RevR.pdf
27. White paper, February 2006, "Need for and benefits of a Modern Spatial Reference Network in Southern New Mexico," coauthored with Gilbert Chavez, Las Cruces City Surveyor and member New Mexico Board of Licensure for Professional Engineers and Professional Surveyors, www.globalcogo.com/whitepaper.pdf
26. "Geomatics Curriculum Design Issues" presented at XXth Surveying & Mapping Educators Conference, June, 2005, Corpus Christi, Texas.
25. "Accuracy of Elevation Reduction Factor," *ASCE Journal of Surveying Engineering*, Vol.130, No. 3, August 2004.
24. "A 3D Datum for a 3D World," *Geospatial Solutions*, Vol. 14, No. 5, May 2004, pp 38-41.
23. "Viewing Spatial Data from a 3-D Perspective," (**Best Paper Award** for conference) Science, Engineering, and Technology Education (SETE) Conference, New Mexico State University, Las Cruces, NM, January 9, 2004.
21. "The Digital Revolution Begets the Global Spatial Data Model (GSDM)," *EOS Transactions*, American Geophysical Union, 15 April, 2003, pp 140-141.
20. "Elevations and the Global Spatial Data Model (GSDM)," presented at 58th Annual Meeting of Institute of Navigation, Albuquerque, New Mexico, June 25, 2002.
19. "The Global Spatial Data Model (GSDM): A New Paradigm for Spatial Information," presented at the FIG International Surveyors Conference, Washington, D.C., April 2002.
18. "Spatial Data, Coordinate Systems and the Science of Measurement," *ASCE Journal of Surveying Engineering*, November 2001, Vol. 127, No. 4, pp 143-156.
17. "The Global Spatial Data Model" presented at the International Conference on Discrete Global Grids hosted by the National Center for Geographic Information & Analysis, Santa Barbara, CA, March 26-28, 2000.
16. "Geomatics Education and the Global Spatial Data Model" presented at the North American Surveying Teachers' Conference, Purdue University, July, 1999.
15. "Spatial Data Accuracy as Defined by the Global Spatial Data Model (GSDM)", *Surveying and Land Information Systems Journal*, Vol. 59, No. 1, March, 1999.
14. "3-D: A Challenge for Surveying in the 21st Century," printed in The AGGIE Surveyor published by the NMSU Department of Surveying Engineering, Spring, 1999.

Publications 14-32 were published since joining the NMSU faculty in 1998. The following publications were written prior to joining the Surveying Engineering Department at NMSU.

13. "A Practical Global Spatial Data Model (GSDM) for the 21st Century," presented at Navigation 2000 - the ION National Technical Meeting, Long Beach, CA, 23 January 1998.
12. Professional Surveyor (series of three articles) -
 -October, 1997: "The Global Spatial Data Model: A Tool Designed for Surveyors"
 -Nov/Dec, 1997: "Using the Global Spatial Data Model (GSDM) in Plane Surveying"

.....Jan/Feb, 1998: "Positional Tolerance Made Easier with the GSDM"

11. "A 3-D Global Spatial Data Model (GSDM)," 1997 GIS/GPS Supplement of The Civil Engineering Surveyor, UK, pp 15-18.
10. "The 3-D Azimuth of a GPS Vector," *ASCE Journal of Surveying Engineering*, Vol. 124, No. 4, pp 139-146, November, 1997.
9. "Definition of a Three-Dimensional Spatial Data Model for Southeastern Wisconsin," May, 1997, a report published by the Southeastern Wisconsin Regional Planning Commission, Waukesha, WI.
8. "Definition and Description of a Global Spatial Data Model" registered with the U.S. Copyright Office, Washington, D.C., April, 1997. www.globalcogo.com/gsdmdefn.pdf.
7. "The 3-D Geodetic Model as the Basis of a Global Coordinate System for Mobile Mapping," presented at the Mobile Mapping Symposium, Columbus, Ohio, May 23-26, 1995.
6. "GIS Applications of GPS Technology via Local Coordinate Systems: Past, Present, and Future," published in Technical Papers of ACSM/ASPRS Annual Meeting, March, 1995, Charlotte, NC.
5. "3-D Coordinates - A Universal Rectangular Coordinate System for a GIS and Other Spatial Databases" published in the Proceedings of the ASCE First Congress on Computing in Civil Engineering, June 20-24, 1994, Washington, D.C.
4. "Design of a Local Coordinate System for Surveying, Engineering, and LIS/GIS," *ACSM Surveying & Land Information Systems Journal*, Volume 53, No. 1, March, 1993.
3. "Using GPS Results in a True 3-D Coordinate System," *ASCE Journal of Surveying Engineering*, Volume 119, No. 1, February, 1993.
2. "Computation of Level/Horizontal Distance," *ASCE Journal of Surveying Engineering*, Volume 117, No. 3, August, 1991.
1. "Geometrical Parameters of the Geodetic Reference System 1980," *ACSM Surveying and Mapping Journal*, Vol. 44, No. 4, 1984, pp 339-340.