Presenter and Credit Information

Presented by
Dr. Thomas H. Meyer *University of Connecticut*

Dr. Meyer is a professor in the Department of Natural Resources and the Environment at UConn's College of Agriculture, Health and Natural Resources (CAHNR). He is a member of the American Society of Civil Engineers and the American Society for Photogrammetry and Remote Sensing, and he is a fellow and past president (2016, 2019) of the American Association for Geodetic Surveying. Dr. Meyer is a past president (2006-2007) of the Geomatics Society of New England (previously known as the New England Section ACSM) and a member of the editorial boards of the *Journal of Surveying Engineering* and *Surveying and Land Information Science*. Dr. Meyer earned his Ph.D. degree from Texas A&M University (College Station, 1998) where he was a research associate in the Mapping Sciences Laboratory. He was named a UConn Teaching Fellow (2015), and he has taught geomatics courses at the graduate and undergraduate levels in geodesy, geographic information science, digital terrain modeling, spatial statistics, and global navigation satellite system surveying. Dr. Meyer has authored an undergraduate-level geodesy textbook and numerous peer-reviewed papers about surveying and mapping, and he teaches professional education seminars for surveyors throughout New England and the United States.

Continuing Education Credit Information

This webinar is open to the public and is designed to qualify for 6.5 PDHs for professional engineers and land surveyors in most states that allow this learning method.

This course is not approved for New York engineers or surveyors. Please refer to specific state rules to determine eligibility.

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Attendance will be monitored, and attendance certificates will be available after the webinar for those who attend the entire course and score a minimum 80% on the quiz that follows the course (multiple attempts allowed).

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Geometric Geodesy for Surveyors and GISPs
Live, Interactive Webinar - Tuesday, January 9, 2024

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Learning Objectives

Geodetic surveying takes the Earth's curvature into account. This allows the surveyor to produce grid coordinates in any formal mapping coordinate system and to compute "true" (geodetic) distances, directions and positions of the reference ellipsoid itself. Students will explore the necessary technical knowledge of geometric geodesy that is necessary to do this.

HalfMoon Education Live Webinars

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Agenda

Geodetic surveying is a branch of land surveying in which the observations are processed to take Earth's curvature into account. Doing so allows the surveyor to produce grid coordinates in any formal mapping coordinate system and to compute "true" (geodetic) distances, directions, and positions on the reference ellipsoid itself. These allow the surveyor to exactly reconcile observations from global navigation satellite system (GNSS) receivers, total stations, and geodetic control values. We begin with a motivating problem: determine the geodetic length and orientation of the Albuquerque International Airport's main runway given the geodetic coordinates of two stations at the ends of the runway. These are then converted to grid coordinates—State Plane 1983, State Plane 2022, and Universal Transverse Mercator—that all give correct, but different values for the length and orientation. Finally, we see the reductions that allow us to reconcile the differences to see that these coordinate systems are interchangeable, given the proper knowledge of geometric geodesy.

Introduction
The length and orientation of the Albuquerque International Airport's main runway by inversing geodetic coordinates at its end points
Converting the end-point coordinates to UTM, SPC83, SPC22, and ground coordinates
Re-computing the length and orientation using the grid coordinates, and seeing all the results are different

Earth Models: Reference Ellipsoids
Semi-major and semi-minor axes, flattening, first and second eccentricit
Radii of curvature, Gaussian curvature
Clarke 1866, GRS 80, WGS 8

Datums, Reference Systems, and Reference Frame
International Terrestrial Reference System
- ECEF
- US NSRS

International Terrestrial Reference Frames: ITRFxx, NAD83(xxxx), WGS84, NATRF2
- Connection to the Global Positioning System and other GNSSs

Time-dependent positioning

Geodetic Coordinates
XYZ
Geodetic Longitude, latitude, and height
- $\lambda, \phi, h \leftrightarrow XYZ$

East, North, up
- $\mathrm{ENU} \leftrightarrow XYZ$

Reconciling GNSS coordinates with total-station observations

Geodetic Distances and Directions
Geodesics
The forward problem
The inverse problem

Grid Coordinates
Conformal projections
- Point-scale factor
- Grid convergence
- Reducing geodesic distances to the mapping plane

SPC83
UTM

The effect of elevation
Topographic enlargement
Elevation factor
Reducing slope distances to a reference ellipsoid

Low-distortion Map Projections
SPC22

Additional Learning

Practical Site Engineering: Science and Techniques
- Friday, December 1, 2023 | 8:30 am - 3:30 pm CST

Wetland Restoration
- Monday, December 4, 2023 | 9:00 am - 4:00 pm CST

Accessible Trail Design, Construction, and Operation
- Tuesday, December 12, 2023 | 8:30 am - 12:15 pm CST
- Wednesday, December 13, 2023 | 8:30 - 11:45 am CST

Current Issues in the Practice of Geology and Geoscience
- Thursday, December 14, 2023 | 8:30 am - 4:00 pm CST

Urban Street Design
- Tuesday, December 19, 2023 | 9:00 am - 4:30 pm CST

Ethical Issues in Structural Engineering
- Wednesday, December 20, 2023 | 11:00 am - 12:00 pm CST

Solar Photovoltaic Energy 2024: Residential and Small Commercial Systems
- Wednesday, December 27, 2023 | 8:30 am - 3:30 pm CST

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