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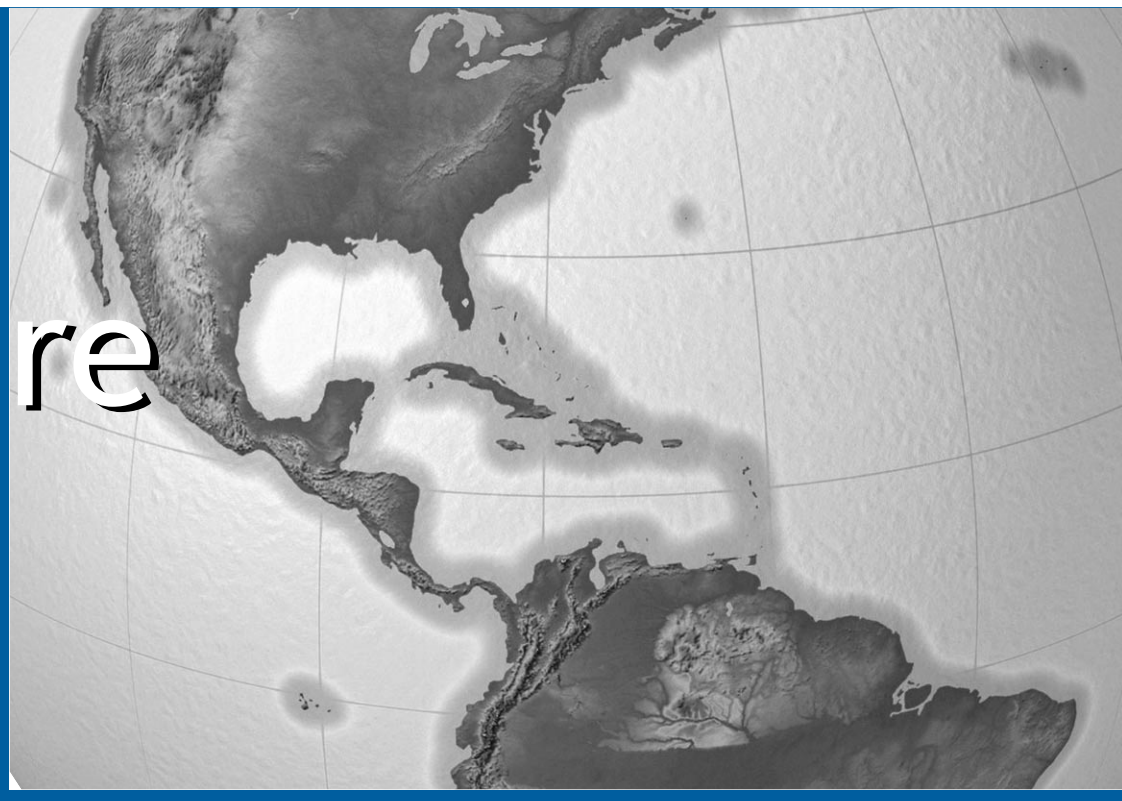
October 20 and 21, 2004
Spatial Reference Systems Seminar

Learn for the Future



Spatial Reference Systems Seminar

October 20 and 21, 2004

UNIVERSITY of CALIFORNIA Riverside
Extension
Learn for Life

Co-sponsored by:

Airborne 1 • APS Inc. • California Geographical Information Association (CGIA) • California Land Surveyors Association (CLSA) • California Spatial Reference Center (CSRC) • Caltrans • Caterpillar Inc. • City of Los Angeles • Civil Applications NAVSTAR • ESRI • Institute of Geophysics and Planetary Physics (IGPP) • League of California Surveying Organizations • Metropolitan Water District of Southern California • Michael McGee Consulting • National Geodetic Surveys (NGS) • RBF and Associates • Riverside County Flood Control District • Scripps Orbit & Permanent Array Center (SOPAC) • UNAVCO Inc. • University of Connecticut

The Program:

This seminar explores spatial reference applications using Global Positioning Systems (GPS) for land surveyors, engineers, GIS professionals and others involved with horizontal and vertical referencing. It is built on the use of NAVSTAR's Global Positioning Systems (GPS). Topics include: The Federal Government's plans for GPS, equating a GPS measurement to the ground, Caterpillar's machine control and guidance system, vertical spatial reference systems as they exist today, GPS heights, geoid models, state plane coordinates, LIDAR based GPS, the future of the National Geodetic Surveys and the next National horizontal adjustment, California Spatial Reference Center, real time GPS kinematic surveying and networks, epochs, velocities, horizontal time-dependent positioning and the possibility of vertical time-dependent positioning, hi-accuracy reference networks (HARNS), continuously operating reference stations (CORS), plans of the Plate Boundary Observatory to establish hundreds of Continuously Operating GPS Reference Stations in California, and especially important everyday access and use of GPS data.

Elective for Certificate in Geographic Information Systems (Data Collection and Data Generation Track)
Elective for Certificate in GPS Technology

Keynote Speaker:

Jack Dangermond is the founder and president of ESRI, the worlds fourth largest privately held software company. Founded in 1969 and headquartered in Redlands, California, ESRI is widely recognized as the technical and market leader in geographic information system (GIS) software, pioneering innovative solutions for working with spatial data on the desktop, across the enterprise, in the field, and on the Web. Mr. Dangermond is recognized not only as a pioneer in spatial analysis methods, but also as one of the most influential people in GIS. Over the last 30 years, Mr. Dangermond has delivered keynote addresses at numerous international conferences, published hundreds of papers on GIS, and given thousands of presentations on GIS around the world.

Moderators:

Gregory A. Helmer is a Professional Land Surveyor in California, Colorado, Nevada, and Arizona with over 20 years of experience in geodetic surveying and mapping. As Vice President of RBF Consulting in Irvine, he has been involved with GPS surveying and high-precision geodesy for the past 16 years and is nationally recognized for his expertise in this field.

Dave Stone, PLS, is the Chief of Surveying and Mapping, Riverside County Flood Control and Water Conservation District and is the past-secretary of the California Spatial Reference Center (CSRC).

Guest Speakers:

Dr. Yehuda Bock is a Research Geodesist for the University of California, San Diego, Institute of Geophysics and Planetary Physics, Scripps Institute of Oceanography (SIO), La Jolla. He is the Director of the Scripps Orbit and Permanent Array Center (SOPAC), member of the Southern California Integrated Global Positioning Systems Network (SCIGN) Executive Committee, and Director of the California Spatial Reference Center.

Michael R. McGee is the Director of Surveying and Senior Advisor on GPS for Airborne I, Santa Barbara. McGee has been licensed as a Professional Land Surveyor since 1971, served as State President of the California Land Surveyors Association in 1985 and presently sits on the CSRC Board of Directors. He offers consulting services to surveyors and engineers on boundary, geodetic and GPS technology and provides expert witness services for attorneys.

Dr. Thomas Meyer is with the Department of Natural Resources Management and Engineering, University of Connecticut, Storrs, Connecticut. Meyer has written numerous articles on GPS, GIS, digital terrain models, and database systems.

Thomas Nagle is the Program Manager for Civil Applications NAVSTAR, Global Positioning Systems Joint Program Office in Los Angeles. The office is with the U.S. Department of Transportation/Federal Aviation Administration (FAA). He is responsible for overseeing all non-Department of Defense users of GPS.

Dr. William H. Prescott, Ph.D is the President of UNAVCO, Inc. Other positions he has held are include Research Geophysicist, U.S. Geological Survey; President, Geodesy Section, American Geophysical Union ; Chairman, Southern California Integrated GPS Network, SCIGN ; and Chief, Branches of Tectonophysics and of Earthquake Geology and Geophysics, USGS. Dr. Prescott has written or collaborated on over 200 publications on various topics including geodetic measurement of horizontal deformation in the northern San Francisco Bay region, and the operations plan for the Southern California Integrated GPS Network.

Steven Rieker is a North American Program Manager for Caterpillar's Machine Control and Guidance business. Mr. Rieker has a BS Mechanical Engineering and has been with Caterpillar for 15 years in development and marketing of construction equipment. In the past two years, he has focused on the market development of machine control and guidance technology for the construction markets.

Michael Rubner is with the Survey Division in the Department of Public Works in Los Angeles. He became a Professional Licensed Surveyor in 1992. Over the years he has had the opportunity to experience several different survey systems utilizing different equipment, procedures, and programs. Currently he supervises the tract analysis desk, Right of Way, and the CAD sections for the City of Los Angeles.

(Guest speakers continued on next page)

Spatial Reference Systems Seminar

Earth Science 454.2 (1.5 units)

A G E N D A

DAY ONE — October 20, 2004

7:30-8am Registration/Continental Breakfast

8am Welcome and Introductions
Greg Helmer, Moderator, California Spatial Reference Center

8:15am GPS Performance and GPS Modernization
Thomas J. Nagle will describe the NAVSTAR GPS program: current status, the government's goals, the program's history, and what the future looks like.

9:15am The Flat Earth Assumption Grid, Ground, and Globe: Distances in the GPS Era
Dr. Thomas H. Meyer reviews various types of distances as they are measured and derived in all the different coordinate systems used by surveyors. Unlike measurements made with transits and levels that are oriented according to gravity and are traditionally considered to be horizontal and vertical, respectively. GPS measurements are inherently three-dimensional and not oriented to the geoid in an obvious way. GPS and optical-mechanical measurements must be reduced to become geodetic quantities. Dr. Meyer discusses the issues, fundamental principals, geodetic computations, and presents a real world measurement procedure showing how to reconcile measured distances (Total Station) and GPS measurements.

10:15am Break

10:30am North American Vertical Datum of 1988 With GPS
Dave Zilkoski discusses establishing the North American Datum of 1988 (NAVD88) using the Global Positioning System (GPS). His discussion includes National Geodetic Survey's (NGS) guidelines for 2 and 5cm GPS derived ellipsoid heights; procedures for analyzing GPS results; basic procedures to follow to establish NAVD88 GPS derived Orthometric heights that meet 2 and 5-cm standards. He also provides a status report on the progress on the National Height Modernization Program.

11:30am Lunch (Provided)

12:30pm California's Spatial Reference Center
Dr. Bock describes the Scripps Orbit and Permanent Array Center where GPS Continuously Operating Reference Stations (CORS) data from all the sites in California and around the world are archived. This data are made available to anybody over the internet free. Also covered will be his role as Director of the California Spatial Reference Center (CSRC) and its affiliation with National Geodetic Survey; adjustments he has made and intends to make to the North American Datum of 1983 for surveyors, engineers, and GIS specialists in the State of California.

1:30pm GPS Real Time Positioning and Automation of Machine Controls by Caterpillar
Steve Rieker examines the value of GPS technology in the earthmoving and construction market. The integration of GPS technology in heavy construction equipment provides contractors with the ability to utilize GPS in machine control and guidance. The benefits of GPS real time positioning and the automation of machine controls allows earthmoving machines to work to three dimensional engineering site plans. The implementation of these technologies will have significant impacts on the entire construction process from concept to completion.

2:30pm Break

2:45pm GPS Surveying and Its Use on Transportation Facilities
Tom Taylor discusses RTK and Kinematic surveying and the use of these techniques for transportation projects. The projects include building bridges, retrofitting underwater transportation tubes, grading and paving roadways. Mr. Taylor also reviews RTK calibrations and network RTK.

3:45pm City and Port of Los Angeles Real Time GPS Network
Michael Rubner brings us up-to-date on the development of the real-time Global Positioning System in the City of Los Angeles. He describes its operation, type of accuracies he expects and the area he plans to cover, procedures for using the network, cost effectiveness, and collaboration with Southern California Integrated GPS Network (SCIGN).

4:45pm Credit Exam (Optional)

5:15pm Reception
Speakers will be available for further discussion and comment.

5:45pm Evening Program
The Role of GIS in Spatial Referencing
Keynote Presenter: Jack Dangermond

DAY TWO — October 21, 2004

7:30-8am Continental Breakfast

8:00 Welcome
Dave Stone, Moderator, Riverside County Flood Control District/League of California Surveying Organizations/California Spatial Reference Center

8:15 Earth Scope's Plate Boundary Observatory
Dr. William Prescott will present a discussion of the Plate Boundary Observatory (PBO) component of the EarthScope initiative. The PBO plans to install a total of 431 Continuously Operating GPS Reference Stations and 150 deep borehole strainmeters in California. Of these, 170 GPS and 64 strainmeters will be installed in Southern California. He will go over their progress in installing the Continuously Operating GPS Reference Stations here in California. The PBO geodetic infrastructure will go a long way towards establishing horizontal and vertical Spatial Reference System in California. The PBO will have an open data policy on all the information collected and produced by their CORS. The stations will be built to scientific standards, with real-time capability. UNAVCO, Inc. the agency responsible for PBO construction are looking for municipal, county, state, federal, and private partners who are interested in hosting GPS and strainmeter instruments.

9:15 LIDAR and GPS
Michael McGee describes Light Detection and Ranging (LIDAR). He will explain how LIDAR is used in an aircraft for topographic mapping when controlled by airborne GPS. He discusses the range of accuracies achievable with LIDAR, its uses and limitations.

10:15 Break

10:30 Basic Steps for Using California Continuously Operating Reference Stations
Cecilia Whitaker will speak about utilizing Continuously GPS (CGPS) Stations data in various types of land surveying projects, including control surveys, record of surveys, monitoring surveys and height modernization. She will also discuss the basic steps to incorporate CGPS data into field surveys, including preparation and planning, accessing and down loading the CGPS RINEX data with new field survey data.

11:30 Lunch (Provided)

12:30 pm Continuation of "Reference Stations" Basic Steps for Using California Continuously Operating

1:30 Horizontal Time-Dependent Positioning (HTDP)
Dr. Snay presents his "Wizardry" for transforming spatial coordinates across time and between reference frames commonly known as the Horizontal Time-Dependent Positioning (HTDP) software. Surveyors, GIS professionals, engineers and cartographers in California need to know how to transform NAD83, its epochs, ITRS and WGS84 to suit their own particular coordinate needs. He discusses its availability, uses, when and how it is maintained. Dr. Snay also examines the challenges of developing a program for Vertical Time-Dependent Positioning (VTDP). He also reports the status of updating NAD83 in 2007 to reconcile state-to-state discrepancies among current HARN coordinates.

3:30 Adjourn/Credit Exam (Optional)

(Agenda subject to change.)

(Guest speakers continued)

Dr. Richard A. Snay is the program manager for the National Continuously Operating Reference Stations (CORS) system, National Geodetic Survey, Washington, D.C. He has served as a geodesist with the NGS since 1974. Dr. Snay designed and developed the Horizontal Time-Dependent Positioning (HTDP) software, which incorporates crustal motion models for precise positioning applications. He served as visiting scientist with the Southern California Earthquake Center in 1992.

Tom Taylor, PLS, is Chief of Survey Standards, External Liaison, and Recruitment for the Office of Geometronics, Caltrans in Sacramento. Taylor has a degree in theoretical mathematics from UC Berkeley. He has worked for the Department of Transportation seven years in all aspects of Surveying including six years of experience in GPS surveying. Taylor is the main author of the Department's RTK specifications and is currently the chief editor of the Caltrans Surveys Manual.

Cecilia Whitaker has been a Professional Land Surveyor in California since 1992. Since joining Metropolitan Water District (MWD) of Southern California, Glendora office, in 1992, she has been coordinating the Deformation Survey's portion of MWD's dam surveillance program. She plans the survey data collection and analysis for 31 existing facilities (20 under state of California jurisdiction). She is one of two Consulting Professional Land Surveyors to the California Spatial Reference Center.

David Zilkoski is the Deputy Director of National Geodetic Survey, Washington, D.C., the past President of the American Association for Geodetic Surveying, and currently on the ACSM Board of Directors. He is also an instructor for the NGS Vertical Control Workshop, the North American Vertical Datum of 1988 (NAVD 88) Seminar, and Leveling-Derived Heights & GPS-Derived Heights Seminar.

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