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Research interests: the use of advanced geodetic techniques to monitor the time variations of the orientation, gravity and topography of the Earth with sufficient accuracy to refine and discriminate among earth models and geodynamical theories.

Education

BS Civil Engineering, University of Pittsburgh, 1961
MS Geodetic Science, Ohio State University, 1965
PhD Civil Engineering, minor in Systems Engineering, University of Arizona, 1973

Professional Experience

2010 to present - Research Professor and Senior Research Engineer, Department of Civil & Environmental Engineering, University of Houston. Responsibility includes evaluating existing and emerging technologies for possible applications to improve the quality of the observational LiDAR and Remote Sensing data for leading edge scientific research and engineering applications.

1996 to 2010 - Adjunct Professor, Department of Civil Engineering, University of Florida.

Research involving the application of advanced geodetic techniques, primarily the Global Positioning System (GPS), absolute gravimetry, and airborne laser swath mapping.

1992 to 1996 - Chief, Geosciences Laboratory (GL), National Oceanic and Atmospheric Administration (NOAA), Silver Spring, MD. The GL was multi-disciplined with research teams organized primarily around advanced technologies, including satellite altimetry, Very Long Baseline Interferometry (VLBI), the Global Positioning System (GPS), and absolute and cryogenic gravimetry. The observational data collected by these techniques were reduced and analyzed to extract information about variations in sea level in the equatorial regions of the Pacific Ocean (ENSO), earth orientation, crustal deformations, plate motion, glacial rebound, change in absolute sea level, earth models, gravity fields, and geoids. The GL had a staff of about 40 scientists, engineers, and technicians, and an annual budget of $3.6M. As Chief, worked with teams to define projects, obtain funding, recruit personnel, purchase equipment, collect and reduce observational data, analyze and publish results. Also carried on independent research in VLBI, GPS and absolute gravimetry independently and cooperatively with colleagues within GL and at other organizations, both governmental and academic.

1981 to 1991 - Chief, Advanced Technology Branch, GL, NOAA. Identified new technologies that could be used to attack long standing problems and open new areas of research in geodesy and geodynamics. Based on my evaluation of VLBI and satellite and lunar laser ranging, selected VLBI as the best technique for monitoring earth orientation and crustal dynamics, and started national and international cooperative efforts to develop a global geodetic VLBI network. In recognition of my contributions and leadership, was selected to be the VLBI Principal Coordinator for the International Earth Rotation Service. Seeking a less expensive technique than VLBI, was one of the first geodesists to explore the use of GPS based geodetic surveying techniques, and assembled a research team that has advanced the state-of-the-art of fixed and kinematic differential GPS. As an independent technique for detecting vertical crustal motion and to study subsurface mass relocation, initiated the development of a one microgal precision absolute gravimeter and a cryogenic relative gravimeter. The absolute gravimeter has recently been used to detect glacial rebound at Churchill, Canada.

1977 to 1981 - Research Geodesist and Chief, Gravity, Astronomy, and Space Geodesy Division, National Geodetic Survey (NGS). Directed geodetic survey projects using relative gravimetry, stellar observations, electronic distance measurements, triangulation, trilateration, and Doppler satellite techniques. Planned and supervised the first high accuracy 3--dimensional geodetic surveys at VLBI stations to connect the antenna reference point to local geodetic control and GPS base stations.

1973 to 1976 - Research Associate, Institute for Astronomy, University of Hawaii. As the head of the lunar laser ranging research project, designed a unique fixed refractor beam collimator and tracking telescope, and an altitude-azimuth mounted beam director (Lunastat) capable of absolute pointing accurate to one second of arc. The fixed telescope and beam director approach has since been adopted at a number of other laser ranging stations. When

construction bids for the observatory building exceeded the available funds, supervised the erection myself using day labor hired locally. When the laser provided by NASA was found to have deficiencies, designed a corrective alignment system, installed it, and trained technicians in its operation. At the cost of a few thousand dollars, modified the lunar ranging system to have artificial satellite capabilities, creating the first such dual capability system in the world. More than two decades later the Lunastat system is still operating and the Haleakala station is one of the most productive satellite laser ranging stations in the world.

1969 to 1972 - Research Geodesist, Air Force Cambridge Research Laboratory, University of Arizona. As a graduate student and full time federal employee, helped to build and operate one of the first successful lunar laser ranging stations in the world. Beginning with a partially complete offset tracking system, which used an image dissector tube to track contrasting lunar features, developed an interactive real time computer controlled system to compute the time varying offsets and keep the laser transmitting/receiving telescope pointed at the lunar retroreflectors. This was the first active tracking lunar offset pointing system and its operation was the subject of my PhD dissertation. When the ruby laser purchased for the station proved unreliable, discovered a structural problem, proposed a new system configuration and designed a new enclosure to solve the problem.

1961 to 1969 - Geodetic Officer, US Air Force - performed geodetic surveys and astronomic position and azimuth observations at ICBM sites. Developed alignment techniques for missile guidance systems and taught geodetic officers and survey technicians to perform the surveys. During tenure as a Geodetic Officer learned to operate geodetic levels, theodolites, and electronic distance measuring instruments. Tested and helped to improve state of the art stellar cameras.

Teaching Experience

1996 to 2010, University of Florida - taught Geodesy, Geodetic Positioning and Special Studies, and supervised graduate student thesis and dissertation research.

1972 to 1976, University of Hawaii - supervised graduate student research projects and served on evaluation committees.

1966 to 1968, University of Wyoming, Cheyenne extension campus - taught Descriptive Astronomy.

Awards

1984, NOAA Administrator s Award. For creative and dynamic leadership in initiating and making operational the POLARIS polar motion monitoring network.

1986, DOC Silver Medal Award. For exceptional contributions to the application of very long baseline interferometry to geodesy, through project POLARIS.

1986, NASA Group Achievement Award. For significant advances in space geodetic measurement technology.

1988, DOC Gold Medal Award. For contributions to the founding and operation of the International Earth Rotation Service.

1989, NASA Group Achievement Award. For response to the Loma Prieta earthquake which provided the first high resolution regional measurements, using advanced VLBI and SLR technology of coseismic and postseismic motion immediately following a major earthquake.

1994, NOAA Technology Transfer Award. For technical contributions underlying the commercial manufacture and sale by a U.S. company of a state-of-the-art absolute gravity meter.

Memberships

Member International Astronomical Union (IAU)
Member American Astronomical society (AAS)
Member American Geophysical Union (AGU)
Member International Union of Geodesy and Geophysics (IUGG)
Fellow International Association of Geodesy (IAG)
1978-1989 IAU/IUGG Project MERIT Principal Coordinator for VLBI
1983-1987 President IAG International Radio Interferometric Surveying (IRIS) Subcommission
1989-1996 IERS Principal Coordinator for VLBI

Conferences Convened

Co-Convener, *National Science Foundation Workshop on Advanced Methods of Mapping Geosurficial Processes*, University of Florida, Gainesville, FL, July 23-25, 2001.

Co-Convener, *AGU Chapman Conference on Microgal Gravimetry: Instruments, Observations and Applications*, St. Augustine, FL, March 3-6, 1997.

Convener, *AGU Chapman Conference on Geodetic VLBI: Monitoring Global Change*, Washington, D.C., April 22-26, 1991.

Publications

Books

Carter, W.E. and M.S. Carter, **Simon Newcomb, America's Unofficial Astronomer Royal,** Mantanzas Publishing, 2006.

Carter, W.E. and M.S. Carter, **Latitude**, Naval Institute Press, 2002.

McCarthy, D.D., and W. E. Carter, editors, ***Variations in Earth Rotation***, Geophysical Monograph 59, IUGG Volume 9, AGU-IUGG, 1990.

Papers

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Fernandez-Diaz, J.C., H. Lee, C.L. Glennie, W.E. Carter, R.L. Shrestha, A. Singhania, M.P. Sartori, and D.L. Hauser (2014), **Optimizing Ground Return Detection through Forest Canopies with Small Footprint Airborne Mapping Lidar**, IEEE International Geoscience and Remote Sensing Symposium (IGARSS) 2014, 1963-1966.

Fernandez-Diaz, J.C., C.L. Glennie, W.E. Carter, R.L. Shrestha, M.P. Sartori, A. Singhania, C.J. Legleiter, and B.T. Overstreet (2014), **Early Results of Simultaneous Terrain and Shallow Water Bathymetry Mapping Using a Single-Wavelength Airborne LiDAR Sensor**, IEEE Journ. Applied Earth Obsers and Remote Sens., 7(2), 623.

Wang, G.W., J. Joyce, D. Phillips, R. Shrestha, and W. Carter (2013), **Delineating and defining the boundaries of an active landslide in the rainforest of Puerto Rico using a combination of airborne and terrestrial LIDAR data, Landslides**, doi: 10.1007/s10346-013-0400-x, Springer-Verlag Berlin Heidelberg.

Glennie, C.L., W.E. Carter, R.L. Shrestha, and W.E. Dietrich (2013), **Geodetic imaging with airborne LiDAR; the Earth's surface revealed**, IOP PUBLISHING, REPORTS ON PROGRESS IN PHYSICS, Rep. Prog. Phys. 76, 086801 (24pp). doi: 10.1088/0034-4885/76/8/086801

Fernandez, J.C, W.E. Carter, R.L. Shrestha, and C. Glennie (2013**), LiDAR remote sensing,** in Handbook of Satellite Applications, Joe Pelton, Scott Madry, Sergio Camacho (Eds.), Springer. 2013

Shrestha, K., W.E. Carter, and T. Cossio (2012), **Shallow Bathymetric Mapping via Multi-Stop Single Photoelectron Sensitivity Laser Ranging**, IEEE Transactions on Geoscience and Remote Sensing, 2012

Fernandez, J.C., W.E. Carter, R.L. Shrestha, C.L. Glennie, M.P. Sartori, and A. Singhania (2012), **Early results from a high-resolution hybrid terrestrial and bathymetry mapping LiDAR**, IGARSS 2012 - 2012 IEEE International Geoscience and Remote Sensing Symposium Location: Munich, Germany , IGARSS 2012 - 2012 IEEE International Geoscience and Remote Sensing Symposium, 4994-4997. doi: 10.1109/IGARSS.2012.6352490

Carter, W.E., R.L. Shrestha, C. Fisher, and S. Leisz (2012), **Geodetic Imaging: A New Tool for Mesopamerican Archaeology**, Eos, Trans. American Geophysical Union, 412-414, 16 October 2012.

Chase, A. F., D.Z. Chase, J.F. Weishampel, J.B. Drake, K.C. Slatton, J.J. Awe, and W.E. Carter (2011), **Airborne LiDAR, archaeology, and the ancient Maya landscape at Caracol**, **Belize**, JOURNAL OF ARCHAEOLOGICAL SCIENCE, 38(2), 387-398. doi: 10.1016/j.jas.2010.09.018

Shrestha, K.Y., W.E. Carter, K.C. Slatton, and T. Cossio (2010), **Mixed topographic and shallow bathymetric mapping via multi-stop single photoelectron laser ranging**. Transactions on Geoscience Remote Sensing, 191, 3436427.

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Raabe, E., M.S. Harris, R.L. Shrestha, and W.E. Carter; **"Determination of Ground Surface and Vegetation in a Coastal Florida Wetland with Airborne Laser Technology,"** Ope-File report 2008-1125, U.S. Department of Interior, U.S. Geological Survey, 2008.

Carter, W. E.., R. L. Shrestha and K.C. Slatton; "Geodetic Laser Scanning ," **Feature Article, Physics Today**, Dec. 2007, pp. 41-47.

Slatton, C., W. E. Carter, R. Shrestha; "Airborne Laser Swath Mapping: Achieving the resolution and accuracy for geosurficial research," **Special Section, (invited) Geophysical Research Letter**, Vol 34, Dec 2007, L23S10.

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Carter, W.E., R. L. Shrestha, and K. C. Slatton, "Photon Counting Airborne Laser Swath Mapping (PC—ALSM)," **Gravity, Geoid and Space Missions,** edited by C. Jekeli, L. Bastos and J. Fernandes (Eds), **published by Springer, IAG International Association of Geodesy Symposia**, Vol. 129, 2005, pp. 214 - 217.

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Professional Activities

Corresponding Editor, EOS, American Geophysical Union, 2001-2003.
