



Curriculum Vitae of
Neal Carter, M.S., P.E.
Principal Engineer
Accident Reconstruction

Kineticorp™

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EDUCATION:

M.S., Mechanical Engineering, University of Utah, Salt Lake City, UT, 2007
B.S., Engineering, Mechanical Specialty, Colorado School of Mines, Golden, CO, 2004

CERTIFICATIONS:

Professional Engineer, State of Colorado
Board Certified in Forensic Engineering, National Academy of Forensic Engineers (NAFE)
Traffic Accident Reconstructionist, Accreditation Commission for Traffic Accident Reconstruction (ACTAR)
Accident Reconstruction Certificate Program, Society of Automotive Engineers, 2016
Remote Pilot, Small Unmanned Aircraft System Rating, Federal Aviation Administration (FAA)

EMPLOYMENT HISTORY: Mr. Carter is a Principal Engineer at Kineticorp, LLC, a Denver-based accident reconstruction and visualization firm. Prior to that, he held the positions of Senior Engineer (2013 to 2018) and Engineer (2007 to 2013) at Kineticorp, and Seals Design Engineer (2004 to 2007) at ATK Launch Systems in Magna, Utah.

EXPERIENCE: Mr. Carter investigates, reconstructs, and researches vehicular accidents. He analyzes evidence, performs calculations using principles of physics, and uses computer simulation to analyze vehicle motion. Mr. Carter has investigated and reconstructed accidents involving passenger vehicles, commercial vehicles, roadside barriers, buses, mining equipment, all-terrain vehicles, electronic convenience vehicles, trains, motorcycles, bicycles, and pedestrians. His experience includes the following:

- Mr. Carter has extensive experience analyzing physical evidence related to vehicular crashes as well as modeling, analyzing, and reconstructing crashes with physics-based computer simulation, planar impact mechanics and damage analysis methods. He has an in-depth knowledge of the physical models used by the following crash analysis software packages: PC-CRASH, HVE, CRASH, SMAC, EDVSM and SIMON.
- Mr. Carter has expertise in collecting, preserving, and analyzing data from in-vehicle Event Data Recorders. He is experienced in retrieval and analysis of crash related data from engine control modules, airbag control modules, powertrain control modules, anti-lock brake sensor modules, rollover sensors, and aftermarket video systems in passenger cars, light trucks, and commercial vehicles.
- Mr. Carter has conducted testing involving vehicle dynamics and acceleration, visibility, on-vehicle data recorders, passenger vehicle braking, pedestrian impacts, and motorcycle dynamics and braking. Mr. Carter has authored publications based on his testing that have been published by the Society of Automotive Engineers *International Journal of Transportation Safety*, in the Society of Automotive Engineers Technical Paper Series, in *Collision: The International Compendium for Crash Research*, and in *Electric Energy*. Topics covered in these articles include the accuracy of witness distance estimates, vehicle damage analysis methods, the use of unmanned aerial vehicle (UAV) footage for reconstruction of physical evidence, rollover crash analysis, simulation of vehicle motion, vehicle deceleration rates, motorcycle crash causation, motorcycle dynamics, event data recorders, and video analysis.
- Mr. Carter is an FAA licensed commercial unmanned aerial vehicle (drone) pilot and regularly conducts research on using aerial vehicles for accident reconstruction.

RESEARCH: Mr. Carter regularly publishes technical articles related to vehicular accident reconstruction. These articles have been published in the Society of Automotive Engineers *International Journal of Transportation Safety*, in the Society of Automotive Engineers Technical Paper Series, in *Collision – The International Compendium of Crash Research*, and in *Electric Energy*. Topics covered in these articles include vehicle damage analysis methods, vehicle deceleration analysis, event data recorders, simulation, motorcycle crash causation, and video analysis. Mr. Carter's current research topics include the use of unmanned aerial vehicles (UAVs) for accident reconstruction, motorcycle dynamics, video analysis, and driver naturalistic behavior.

PROFESSIONAL AFFILIATIONS: Mr. Carter is a member of the National Academy of Forensic Engineers (NAFE), and the Society of Automotive Engineers (SAE). He is actively serving as an organizer for the SAE World Congress Accident Reconstruction session and as a peer reviewer for SAE technical papers.

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Peer-Reviewed Publications: Mr. Carter authored or co-authored the following peer-reviewed publications:

- Carter, Neal, Beier Steven, Cordero, Rheana, “Lateral and Tangential Accelerations of Left Turning Vehicles from Naturalistic Observations,” Currently under peer review for SAE World Congress 2019
- Carter, Neal, Hashemian, Alireza, McKelvey, Nathan, “An Optimization of Unmanned Aerial Vehicle Image Based Scanning Techniques for Mapping Accident Sites,” Currently under peer review for SAE World Congress 2019
- Rose, Nathan A., Carter, Neal, Neale, William T.C., McKelvey, Nathan, “Braking and Swerving Capabilities of Three-Wheeled Motorcycles,” Currently under peer review for SAE World Congress 2019
- Rose, Nathan A., Carter, Neal, “An Analytical Review of Two Decades of Research Related to PC-Crash Simulation Software,” SAE Technical Paper 2018-01-0523.
- Rose, Nathan A., Carter, Neal, Smith, Connor, “Further Validation of Equations for Motorcycle Lean on a Curve,” SAE Technical Paper 2018-01-0529.
- Rose, Nathan A., Carter, Neal, Pentecost, David, and Hashemian, Alireza, "Video Analysis of Motorcycle and Rider Dynamics During High-Side Falls," SAE Technical Paper 2017-01-1413, 2017, doi:10.4271/2017-01-1413.
- Rose, Nathan A., Carter, Neal, Beauchamp, Gray, “The Accelerations Present During the Trip Phase of a Soil-Tripped Rollover Crash – An Update,” *Collision: The International Compendium for Crash Research*, Fall 2016.
- Rose, Nathan A., Carter, Neal, “The Longevity of Scene Evidence from a Rollover – A Case Study,” *Collision: The International Compendium for Crash Research*, Fall 2016.
- Rose, Nathan A., Carter, Neal, Kreisher, John, Randolph, Martin, Neale, William T.C., Danaher, David, “How Accurate Are Witness Distance Estimates Given in Car Lengths?” *Collision: The International Compendium for Crash Research*, Spring 2016.
- Rose, Nathan A., Carter, Neal, “The Accelerations Present during the Trip Phase of a Soil-Tripped Rollover Crash,” *Collision: The International Compendium for Crash Research*, Spring 2016.
- Carter, Neal, Hashemian, Alireza, Rose, Nathan A., and Neale, William T.C., "Evaluation of the Accuracy of Image Based Scanning as a Basis for Photogrammetric Reconstruction of Physical Evidence," SAE Technical Paper 2016-01-1467, 2016, doi:10.4271/2016-01-1467.
- Bortles, William, Biever, Wayne, Carter, Neal, and Smith, Connor, “A Compendium of Passenger Vehicle Event Data Recorder Literature and Analysis of Validation Studies,” SAE Technical Paper 2016-01-1497, 2016, doi:10.4271/2016-01-1497.
- Rose, Nathan A., Carter, Neal, and Beauchamp, Gray, “Post-Impact Dynamics for Vehicles with a High Yaw Velocity,” SAE Technical Paper 2016-01-1470, 2016, doi:10.4271/2016-01-1470.
- Carter, Neal, Rose, Nathan A., and Pentecost, David, "Validation of Equations for Motorcycle and Rider Lean on a Curve," *SAE Int. J. Trans. Safety* 3(2):126-135, 2015, doi:10.4271/2015-01-1422.
- Rose, Nathan A., and Carter, Neal, “Further Assessment of the Uncertainty of CRASH3 ΔV and Energy Loss Calculations,” SAE Technical Paper 2014-01-0477, 2014, doi:10.4271/2014-01-0477.
- Rose, Nathan A., Carter, Neal, and Pentecost, David, “Vehicle Acceleration Modeling in PC-Crash,” SAE Technical Paper 2014-01-0464, 2014, doi:10.4271/2014-01-0464.
- Rose, Nathan A., Carter, Neal, Pentecost, David, Voitel, Tilo, and Bortles, William, “Using Data from a DriveCam Video Event Recorder to Reconstruct a Vehicle-to-Vehicle Impact,” SAE Technical Paper 2013-01-0778, 2013, doi:10.4271/2013-01-0778.
- Carter, Neal, Beauchamp, Gray, and Rose, Nathan A., “Comparison of Calculated Speeds for a Yawing and Braking Vehicle to Full-Scale Vehicle Tests,” SAE Technical Paper 2012-01-0620, 2012, doi:10.4271/2012-01-0620.

Technical Articles: Mr. Carter authored or co-authored the following technical articles:

- Carter, Neal, and Rose, Nathan A., “The Role of Vehicle Crash Data Recorders in a Motor Vehicle Safety Program,” *Electric Energy*, 2015 Issue 2.
- Rose, Nathan A., Carter, Neal, and Pentecost, David, “Analysis of Motorcycle and Rider Limits on a Curve,” *Collision: The International Compendium for Crash Research*, Volume 9, Issue 1, Spring 2014.
- Rose, Nathan A., Neale, William, and Carter, Neal, “Using Data from a DriveCam Video Event Recorder to Reconstruct a Hard Braking Event,” *Collision: The International Compendium for Crash Research*, Volume 7, Issue 1, Spring 2012.

Book Chapters: Mr. Carter authored or co-authored the following book chapters:

- Carter, Neal, Hashemian, Alireza, Rose, Nathan A., and Neale, William T.C., "Evaluation of the Accuracy of Image Based Scanning as a Basis for Photogrammetric Reconstruction of Physical Evidence," Chapter 9 in Collision Reconstruction Methodologies Volume 1: Collision Documentation, Edited by Chris Armstrong, PT-186_1, SAE International, 2019.
- Carter, Neal, Rose, Nathan A., Pentecost, David, “Validation of Equations for Motorcycle and Rider Lean on a Curve,” Chapter 9 in Collision Reconstruction Methodologies Volume 4: Motorcycle Accident Reconstruction, Edited by Chris Armstrong, PT-186_4, SAE International, 2019.
- Rose, Nathan A., Neal Carter, David Pentecost, Alireza Hashemian, “Video Analysis of Motorcycle and Rider Dynamics During High-Side Falls,” Chapter 13 in Collision Reconstruction Methodologies Volume 4: Motorcycle Accident Reconstruction, Edited by Chris Armstrong, PT-186_4, SAE International, 2019.

Funded Research: Mr. Carter received funding for the following research:

- “Video Analysis of Concussion Causing Events in Professional Football,” funded by Biocore LLC, 2016-2017.
- “Video Analysis of Concussion Causing Events in Professional Football – A Pilot Study,” funded, in part, by the National Football League, 2015.
- “Using Data from a DriveCam Video Event Recorder to Reconstruct a Hard Braking Event,” funded, in part, by DriveCam - The Driver Science Company, 2011-12.
- “Using Data from a DriveCam Event Recorder to Reconstruct a Vehicle-to-Vehicle Impact,” funded, in part, by DriveCam - The Driver Science Company, 2012-13.

Technical Presentations: Mr. Carter presented the following topics:

- “An Analytical Review of Two Decades of Research Related to PC-Crash Simulation Software,” Society of Automotive Engineers Technical Paper Presentation, 2018 Society of Automotive Engineers World Congress, Detroit, Michigan, April 10, 2018.
- “Further Validation of Equations for Motorcycle Lean on a Curve,” Society of Automotive Engineers Technical Paper Presentation, 2018 Society of Automotive Engineers World Congress, Detroit, Michigan, April 10, 2018.
- “How Accurate are Witness Distance Estimates Given in Car Lengths?” California Department of Transportation 2016 Tort Conference, Folsom, California, May 20, 2016.
- “Evaluation of the Accuracy of Image Based Scanning as a Basis for Photogrammetric Reconstruction of Physical Evidence”, Society of Automotive Engineers Technical Paper Presentation, 2016 Society of Automotive Engineers World Congress, Detroit, Michigan, April 13, 2016.
- “Driver Distraction and its Associated Risk”, RMEL Safety Roundtable, Fort Collins, Colorado, November 14, 2014.
- “Accident Investigation and Reconstruction: Techniques to Determine the Root Cause”, RMEL Safety and Technical Training Conference, Lone Tree, Colorado, April 23, 2014.
- “The Reliability of Crash-Triggered Video and Data Recorders for Accident Reconstruction”, 2013 ARC-CSI Crash Conference, Las Vegas, Nevada, May 14, 2013.
- “Using Data from a DriveCam Video Event Recorder to Reconstruct a Vehicle-to-Vehicle Impact”, Society of Automotive Engineers Technical Paper Presentation, 2013 Society of Automotive Engineers World Congress, Detroit, Michigan, April 17, 2013.

Technical Presentations, Continued:

- “Comparison of Calculated Speeds for a Yawing and Braking Vehicle to Full-Scale Vehicle Tests”, Society of Automotive Engineers Technical Paper Presentation, 2012 Society of Automotive Engineers World Congress, Detroit, Michigan, April 25, 2012.
- “Development, Evaluation, and Qualification of Low-Temperature Seal Materials for RSRM Use”, 2006 NASA Seal/Secondary Air Flow System Workshop, Cleveland, Ohio.

Technical Conferences, Training and Seminars: Mr. Carter attended the following:

- Pix4D User Workshop, Pix4D SA, Denver, Colorado, April 30 – May 1, 2018.
- Society of Automotive Engineers (SAE) World Congress, Detroit, Michigan, April 10-11, 2018.
- “2018 EDR Summit,” Collision Publishing Inc, Houston, TX, March 5-7, 2018.
- “Photogrammetry And Analysis Of Digital Media,” Society of Automotive Engineers, Troy, MI, December 13-15, 2017.
- “Driver’s Responses at Curves, Roadside Obstacles, and Intersections,” webinar presented by Jeffrey Muttart, April 17, 2017.
- Society of Automotive Engineers (SAE) World Congress, Detroit, Michigan, April 4-5, 2017.
- “2017 EDR Summit,” Collision Publishing Inc, Houston, TX, March 6-8, 2017.
- “Introduction to Brake Control Systems e-Seminar,” Society of Automotive Engineers, completed December 1, 2016.
- “Driver’s Responses at Traffic Signals and Intersections,” webinar presented by Jeffrey Muttart, November 16, 2016.
- “Persuasive Presentations,” Duarte Inc., Online Training, completed October 10, 2016.
- “Vehicle Crash Reconstruction Methods,” Society of Automotive Engineers, Scottsdale, AZ, September 28-30, 2016.
- “UAS Flight Safety Program,” 1UP Aerial Drone Services, Inc., Greenwood Village, CO, September 23, 2016.
- “Presenting Data and Information,” Edward Tufte, Denver, Colorado, July 22, 2016.
- Society of Automotive Engineers (SAE) World Congress, Detroit, Michigan, April 13-14, 2016.
- “Applied Vehicle Dynamics,” Society of Automotive Engineers, Greer, South Carolina, November 16-18, 2015.
- “Flight Ready Boot Camp,” Unmanned Experts and Roswell Flight Test Crew, Aurora, Colorado, July 24-26, 2015.
- “Initial Qualification Training Course (IQT1) – Small UAS,” Unmanned Experts Online Training, completed July 23, 2015.
- “Reconstruction and Analysis of Rollover Crashes of Light Vehicles,” Society of Automotive Engineers, Detroit, Michigan, April 24, 2015.
- “Reconstruction and Analysis of Motorcycle Crashes,” Society of Automotive Engineers, Detroit, Michigan, April 23, 2015.
- “UAS Set to Revolutionize Public Safety,” Leica Geosystems, January 14, 2015.
- “Accessing and Interpreting Heavy Vehicle Event Data Recorders,” Society of Automotive Engineers, Oxnard, California, October 21-24, 2014.
- RMEL Safety and Technical Training Conference, Lone Tree, Colorado, April 23, 2014.
- 2013 ARC-CSI Crash Conference, Las Vegas, Nevada, May 14-15, 2013.
- Society of Automotive Engineers (SAE) World Congress, Detroit, Michigan, April 17-18, 2013.
- “Driver Distraction from Electronic Devices: Insights and Implications,” Society of Automotive Engineers, April 3 and 5, 2013.
- Crash Data Retrieval (CDR) System Analysis and Applications Course, Crash Data Specialists LLC, North Las Vegas, Nevada, March 26-29, 2013.
- “Distracted Driving: An Outbreak of Irresponsibility,” presented by DriveCam, Inc, March 6, 2013.
- “New Features in PC-Crash 9.1,” presented by MEA Forensic, February 12, 2013.

Technical Conferences, Training and Seminars, Continued:

- Society of Automotive Engineers (SAE) World Congress, Detroit, Michigan, April 25-26, 2012.
- “Signal Timing and Operations,” University of California, Berkeley, Institute of Transportation Studies, Sacramento, California, February 1-2, 2012.
- Motorcycle Safety Foundation® Basic RiderCourse , Aurora, Colorado, September 10-11, 2011.
- Expert Topics in PC-Crash Workshop, Orlando, Florida, April 7-8, 2011.
- Essentials of PC-Crash Workshop, Orlando, Florida, April 6, 2011.
- Bosch Crash Data Retrieval (CDR) System® Level 2 Technician Course, Kineticorp, LLC, Greenwood Village, Colorado, March 8, 2011.
- Bosch Crash Data Retrieval (CDR) System® Level 1 Technician Course, Kineticorp, LLC, Greenwood Village, Colorado, March 8, 2011.
- “Design of Experiments for Engineers,” Society of Automotive Engineers, Troy, Michigan, August 5-6, 2010.
- 2009 VAMPIRE User Day, Chicago, Illinois, October 8, 2009.
- “CVSA Out of Service Seminar,” Colorado Motor Carriers Association, Denver, Colorado, August 27, 2009.
- ME5238 – Impact Mechanics, University of Colorado at Denver, Summer 2009.
- VAMPIRE Railway Vehicle Dynamics Simulation Software Training, 1-Week Course Presented by Rail Sciences, Inc., Greenwood Village, Colorado, July 6-10, 2009.
- “VBOX Product Training”, VBOX USA, Denver, Colorado, April 21, 2008.
- “Tire Mechanics & Modeling,” Course Presented by Dr. Patrick Fitzhorn, Director of the Race Vehicle Dynamics Laboratory at Colorado State University, Denver, Colorado, March 20, 2008.
- 2006 NASA Seal/Secondary Air Flow System Workshop, Cleveland, Ohio.