

JUDSON B. WELCHER, Ph.D

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Accident Reconstruction and Biomechanical Engineering

EDUCATION

Aug. 9, 2011 — **University of Southern California** – Los Angeles, CA
Ph.D., Biomedical Engineering

Dissertation "Development, Validation and Testing of a New Sensor Array for Intra-Articular Pressure Measurement: In-Vitro Human Lumbar Spine Intra-Articular Facet Testing."

July 2005 - Jan. 2010 — **Biomechanics and Spinal Research Laboratory, Institute for Spinal Disorders**
Stipend Student, Cedars-Sinai Medical Center

Jan. 2003 - April 2005 — **USC Orthopaedic Research Laboratory**
Researcher, Department of Orthopaedic Surgery

Dec. 2001 — **University of Southern California** – Los Angeles, CA
Master of Science, Biomedical Engineering

Thesis "Whiplash Associated Disorders: Related Anatomy, Biomechanics of Injury, and the Relationship between Injury Potential and Automotive Seat Design."

June 2000 — **Vetronix Corporation** (Bosch)– Santa Barbara, CA
Certified Crash Data Retrieval (CDR) System Operator. Recertified 2003, 2019.

Feb. 1995 — **Accreditation Commission for Traffic Accident Reconstruction (ACTAR)** – Denver, CO
Accredited Traffic Accident Reconstructionist, registration number 628

1990 — **California Polytechnic State University** – *San Luis Obispo, CA*
Bachelor of Science, Mechanical Engineering

EMPLOYMENT SUMMARY

Oct. 1994 - Present — **Aperture, LLC. [1/1/22- formerly Biomechanical Research & Testing, LLC.]** – Long Beach, CA
Biomechanical Engineer and Accident Reconstructionist / Principal

Responsible for the analysis of injury-causing accidents and accident reconstruction. This includes vehicle inspections, accident reconstruction and necessary biomechanical engineering calculations. Performs biomechanical testing to determine occupant response to various types of accidents and forces. Conducts fully instrumented tests in which human subjects are used (has conducted over 1000 instrumented vehicle impact tests). Data collected includes acceleration, high speed film/video, and electromyography (EMG). Has evaluated bumper, restraint system and seat design/response to impact. Conducts ongoing research to evaluate human tolerance and injury mechanisms associated with accidents. Performs biomechanical analyses of various events for purposes of litigation, including impact reconstruction and occupant force exposure and injury potential.

Provides forensic consultation for amusement park incidents involving the evaluation of occupant force exposure and injury potential. Consults with theme park developers and

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amusement park operators to test and determine vehicular and biodynamic response of various rides and attractions. Conducts fully instrumented human subject testing of amusement park attractions. Has tested roller coasters, motion platforms, water rides, go-kart/bumper cars, and video arcade attractions for purposes of ride evaluation, design and development. Served on the ASTM F-24 committee to develop biodynamic standards for testing and evaluation of amusement rides.

6/22/09 & 1/28/10 **Clark Training Center, Law Enforcement & Public Safety Training**
Instructor – Traffic Collision Investigation (TCI) – Reconstruction (POST certified)

Teach a half day course on an "Introduction to Biomechanics – Occupant Kinematics and Collision Trauma Biomechanics (injury)." Topic covered include: Definitions of Occupant Kinematics and Biomechanics, Occupant Protection Systems, Occupant Kinematics in Frontal, Rear, Side (near and far), Rollovers and Other Crashes, Occupant Simulation Models for Occupant Kinematics, and Sources of Information and References.

1996 - Dec. 2001 **Texas A&M University, Texas Engineering Extension Service** – College Station, TX
Assistant Adjunct Professor / Instructor

Taught (beginning in 1999) "Collision Trauma Biomechanics" courses periodically through the year. Taught "Analysis of Low-Speed Collisions" courses periodically through the year.

Sept. 1990 - Oct. 1994 **Biodynamics Engineering, Inc.** – Pacific Palisades, CA
Biomechanical Engineer

Responsible for the biomechanical analysis of injury-causing accidents. This included evaluation of accident reports, witness statements and medical records, as well as vehicle inspections, accident reconstruction and engineering calculations. Performed biomechanical testing and research to determine human response to various events.

June 1989 - Sept. 1989 **Baxter Healthcare Corporation Edwards Division** – Irvine, CA
Associate Engineer

Responsible for a root-cause analysis of product failure in an 8F Cardiac Monitoring Catheter. This involved a thorough examination of all the steps of the manufacturing process, with special emphasis on biological compatibility, material selection and processing time. Supervised the inspection of raw fiber optic cables, including training in light dispersion analysis. Constructed and qualified a test fixture for a Right Heart Ejection Fraction Catheter.

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CONTINUING EDUCATION

March 2025 *Human Factors and Ergonomics Society Research Conference – Long Beach, CA, March 15, 2025.*
Topics included: vehicle interfaces and screens influence on driving performance, visual impairments, roadway signage and driver's propensity to use turn indicators, driver performance during automated driving, driving simulation, effects of cell phones on driver performance and blind spot monitoring, influences in human-automation team performance.

March 2025 *Event Data Recorder (EDR) Summit – Houston, TX, March 10-13, 2025*
Topics included: Bosch updates; SAE Committee update on the status of 49CFR563 related regulations; Artificial Intelligence 101; Access and Retrieval of Rivian EDR data including data examples; Data from Airbag Modules recovered from burned modules; Analysis of the legal and practical applications of "non-standard" data retrieval tools; Investigation of events involving Waymo self-driving ride service vehicles; Delta V from speed data, Using pre-crash data timing variations relative to time zero for time and distance analysis; Nondestructive data retrieval from damaged modules; How AI will play a role in cars, crash investigation and data analysis; pedestrian data from Toyota, Subaru and GM PPM/PedPro/Ped event systems; Private Investigator and expert witness licensing considerations and EDR; Hyundai and Kia Data Update; Tesla data updated including insight into data analysis associated with Tesla "FSD" capabilities. (sponsor of event)

Nov.1, 2024 NHTSA-Crash Injury Research and Engineering Network (CIREN) Research 2024 Overview.
Sex Differences in Chest, Thoracolumbar, and Abdominopelvic Injury Patterns and Causation in Frontal Motor Vehicle Crashes; Improving the CIREN FE Reconstruction Framework: Characterizing and Addressing the Effects of Misspecification in Occupant Characteristics, Vehicle Characteristics, and Crash Pulse Shape; Male-Female abdominal injuries in belted frontal impact: a CIREN case study; Transportation Data Linkage and Cost of Injury Analysis; Anatomical Analysis of Sex-Based Differences in Lower Extremity Injury Risk from Frontal Collisions.

Oct.28, 2024 NHTSA Safety Research Portfolio Public Meeting
(Day 1 only) Crashworthiness, Experimental and Computational Biomechanics & Injury, Advanced Crash Test Dummies:
Crashworthiness: Comparison of Seat Belt Elongation Requirements, Interior Impact Protection, Glazing Materials, Motorcycle Helmets, Child Restraints, Bus Rollover Structural Integrity, Advanced Automatic Crash Notification.
Experimental and Computational Biomechanics & Injury: CIREN Update, Experimental Biomechanics/Anthropometry of Average Females/Vulnerability, Older Occupant Injury Research, Female Frontal Thorax, Female Side Thorax/Pelvis, Injury Risk Evaluation using Human Body Models and Machine Learning/Virtual Testing, ADS (Automated Driving Systems) Forward Facing & Abdomen/Pelvis/Lumbar, ADS Rear Facing.
Advanced Crash Test Dummies: Field Data and Research Planning Documents, ATD considerations and Virtual Testing as a Supplement, Development of New Crash Test Dummies.

Oct. 25, 2024 *Southwestern Association of Technical Accident Investigators (SATAI) – Glendale, AZ*
(Day 1 only). Brad Muir – Updates to Toyota Techstream and CDR. Daniel Vomhoff – Handheld LIDAR Scanning and Crush Analysis.

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Feb. 5-7, 2024 *Event Data Recorder (EDR) Summit – Houston, TX*
Topics included: Bosch CDR tool updates; GM front camera module (FCM) and active safety control module (ASCM) updates, analysis and case examples; Toyota Safety Sense (TSS) testing and utilization; heavy truck EDR updates; digital forensics, analysis and testing of cell phone data; automated traffic signal performance measures and applications with EDR data; Hyundai/Kia updates and data analysis; speed recording case example and testing on a 2018 RAM ProMaster 1500 EDR module; Toyota/Lexus Techstream updates and utilization; vehicle infotainment forensics and updates; Analysis of Nissan delta V polarity reporting; Tesla CAN bus data and retrieval. (sponsor of event)

Jan. 2024 *Southwestern Association of Technical Accident Investigators (SATAI) – Glendale, AZ*
Topics Included: 3D Technologies for Crash Scene Documentation, Motorcycle Reconstruction Topics, Digital Forensics, The Biomechanics of Motorcycle Helmets, and Crash Test Data Review

April 2023 *World Reconstruction Exposition (WREX) – Orlando, FL*
Topics Included: A Historical Perspective on Technology in Recon – Then and Now; The Future of Recon: Data Driven; Accident Reconstruction and ADAS; Next Generation GM ACM EDRs / ASCMs / Front Camera Module EDRs; Introduction to Forensic Acquisition of Mobile Devices in Accident Reconstruction; The Forgotten Force – Motorcycle-to-Auto Side Impact Modeling; Injury Biomechanics and the Accident Reconstructionist; The Use of Mobile Device Lidar in Collision Reconstruction; Injury Reconstruction with Biofidelic Dummy, Methods for Establishing Motorcycle Impact Speed; Working with GoPro and GPS Data; Crash Test Data Review.
Invited presenter

March 2023 *Southwestern Association of Technical Accident Investigators (SATAI) – Glendale, AZ*
Topics Included: Vehicle System Forensics, EDR Updates, Forensic Photography, Application of iNPUT-ACE for Vehicle Speed Video Analysis, and Crash Test Data Review.

Dec. 5-9, 2022 *Simcenter Madymo Introduction – Signal Hill, CA*
Topics included: Madymo user interface, multibody systems and models, joint simulation, seat belt modeling and simulation, vehicle seat material characteristics, ATD positioning, FE modeling, contact definitions, airbag modeling, biomechanical data analysis, data visualization.

Oct 2022 *Accessing and Interpreting Heavy Vehicle Event Data Recorders C1022– Mecanica Scientific Services, Oxnard, CA. SAE International.*
Topics included: Primer on Multiplexed Vehicle Electronics Systems and Vehicle Data Networks- Network architecture -- SAE J1587/J1708; SAE J1939; Industry standards for EDR devices -- SAE J2728; TMC RP1210; Other industry standards; Potential government regulations; Accessing and Imaging Data; HVEDR Devices and Data Currently Available on Heavy Vehicles - Engine control systems --Detroit Diesel; Mercedes-Benz; Cummins, Electronic Control Units - Caterpillar; Mack; Volvo; International; PACCAR
Active Safety Systems - VORAD; ABS & Stability Control Systems; Collision Warning & Active Braking Systems; Lane Departure Systems; Inspecting the Vehicle Chassis & powertrain identification and health Vehicle configuration Collision damage; Validation Studies and the Accuracy/Reliability of HVEDR Data; Interpreting and Applying HVEDR Data - Determining whether data imaged from a HVEDR is related to an incident of interest, Determining where impact occurred in dataset, Comparing vehicle speed to engine speed Determining gear selection, Determining travel distance, Determining acceleration/deceleration, Determining driver inputs, Rollover signatures, Rear impacts.

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Feb. 2022 *Southwestern Association of Technical Accident Investigators (SATAI) – Glendale, AZ*
Topics included: Human Factors - Nighttime Visibility, Human Factors – Retroreflectivity, Toyota Safety Sense and Vehicle Control History; Electric Scooter/Occupant Crash Test Results; Laser Scanner Comparisons, Laser Scanning & Photogrammetry.

Oct. 2021 *Advanced Troubleshooting & Vehicle Systems for the CDR/EDR Operator-Technician Kent E. Boots & Associates*
Topic include: Advanced data collection methods, Electrical Terms & conventions, Hands-on practical application on damaged vehicles, Making specialized cables and adapters, Obtaining, reading, and understanding diagnostic trouble codes, Reading and understanding electrical schematics and other vehicle service information, Relevant vehicle system sensors and components, Repowering vehicles and ACMs in complex situations, Using multi-meters and other test equipment, Vehicle electrical system troubleshooting.

Nov. 2020 *CloudCompare Course (ai2-3D, Eugene Liscio)* - Online
Learn step-by-step how to navigate and adjust software settings, as well as import, export, edit and convert files in CloudCompare. .How to use CloudCompare greatest tools such as subsampling, ambient occlusion, DB Tree, Scalar Fields, measurements & point picking, segmentation, ELipser App and much more. Learn step-by-step you how to register, merge and delete scans in CloudCompare. Animate your 3D model and use it as a main element in your projects.

May-Aug. 2020 *Event Data Recorder Analysis in Traffic Crash Reconstruction (Ruth Consulting) – Online*
Topics included: Analysis and applications of EDR data from all supported manufacturers to date for use in traffic collision reconstruction, including event-related and pre-crash data elements. Manufacturer-specific scenarios and data interpretation was addressed.

March 2020 *Event Data Recorder (EDR) Summit – Houston, TX*
Topics included: Bosch CDR tool updates, “End of Event” analysis; CDR retrieval and ignition cycle analysis; Traffic signal as an EDR; Testing and validation of Toyota vehicle control history data; ATV rollover case study, Subaru ADAS system; Pedestrian Automatic Emergency Braking (P-AEB); Berla infotainment data analysis; Autonomous emergency braking as event data; Examples of forensic investigations using the Berla digital tool; Nissan steering and event recording threshold.

Feb. 2020 *PhotoModeler Technologies – Signal Hill, CA*
PhotoModeler for Collision Investigation. Four-day training course on use of PhotoModeler for Collision Reconstruction. Topics included: An intro to the PhotoModeler interface, planning and photography, troubleshooting, camera calibration, utilizing scan data with photographs in PhotoModeler, and proper techniques with taking photographs of vehicles for use in PhotoModeler.

April 2019 *The Society of Automotive Engineers (SAE) 2019 World Congress Conference & Exhibition – Detroit, MI*
Topics included: applications of PhotoModeler, laser scanning and sUAS imagery in accident reconstruction, reconstruction of 3D accident sites using USGS LiDAR, aerial images, and photogrammetry, application of reverse camera projection, VirtualCrash.com occupant simulation analysis, airbag deployment rates using data from NASS database, vehicle dynamic response and damage in low-to-moderate speed side impacts, using adjusted force-displacement data to predict the EBS of vehicle to barrier impacts, low speed override of passenger vehicles with heavy trucks, speed of child cyclists, driver behavior in left turning vehicles, accelerations of left turning vehicles from naturalistic observations, FRED II quasistatic seat back strength testing device, seat performance and

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occupant motions in all-belts-to-seat in rear impacts, influence of degenerative spinal conditions in spinal fractures and cord injuries in rear impacts, occupant kinematics in low speed far-side lateral impacts, thoracic spine extension injuries in occupants with pre-existing conditions during rear-end collisions, estimation of the relative roles of belt-wearing rate, Delta V, and several occupant variables in frontal impacts, and occupant kinematics and loading in low-to-moderate speed frontal and rear-end collisions.

March 2019 *Event Data Recorder (EDR) Summit – Houston, TX*
Topics included: Bosch CDR 900 tool, U-Haul EDR data analysis, steering, yaw and lateral acceleration stability control system data analysis, autonomous vehicle technology and reconstruction, velocity analysis from video cameras, Tesla EDR case studies and data analysis, analysis of Berla iVe system data, infotainment and EDR correlation, EDR data and retrieval in car fires, determining vehicle speed from an audio recording, impacts dynamics with guardrail crashes, and motorcycle reconstruction with EDR data.

Nov. 2018 *Diversified Technical Systems: Principles of Dynamic Data Collection – Seal Beach, CA*
Topics included: Principles of data acquisition, and data acquisition equipment and collection methods in injury biomechanics, ATD's, and automobile crashes.

Aug 10, 2018 CA^{2}RS Training Conference, Fontana, CA
Evaluating Injury Causation in Motor Vehicle Accidents: Applied Biomechanics and Clinical Science.

Apr. 2018 *Society of Automotive Engineers World Congress – Detroit, MI*
Topic included: Human factors and ergonomics as it pertains to operation of autonomous vehicles, research in improved areas of photogrammetry, videogrammetry, and laser scanning, accident reconstruction topics such as CDR data interpretation and methods for validating data integrity.

Feb. 2018 *Engineering Dynamics Corporation (EDC) 2018 HVE Forum Workshop – Charleston, SC*
Courses attended: Advanced HVE: Parts I-III, 3D Vehicles. Pt. I: SIMON, DyMESH 3D Collision Model, HVE White Paper Session, 3D Editor: Functionality/Friction/Importing, Simulation Movies: HD Video Output, and Building a Vehicle for HVE & HVE-2D.

Feb. 2018 2018 *I.DRR Users Forum – Austin, TX*
Topics included: Night time visibility and human factors, path intrusion, perception-reaction time and its effects on vehicle impacts, plausibility of crash avoidance, effects of sun position on PRT, gap acceptance, headlight analysis and object recognition.

Sept. 2017 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference – Las Vegas, NV*
Topics included: reconstruction from body worn cameras, gap acceptance (how far aware must an approaching vehicle be before a driver will pull out?), NTSB highway crash investigations with recent cases and issues, reconstruction and injury analysis in low-speed inline collisions, pedestrian and nighttime recognition, deploying drones, collision scene mapping using UAS technology, unmanned aircraft techniques, quantitative study of passenger vehicle braking performance during emergency application, overheating of heavy duty truck brakes, pedestrian walking speeds, and pedestrian crash reconstruction methodologies.

May 2016 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference – Las Vegas, NV*
Topics included: IIHS small overlap crash tests, photography for crash reconstruction, use of NHTSA NASS crash database in reconstruction, safely working around hybrids/electric vehicles/newer safety systems, motorcycle reconstruction techniques tied to testing, scene and vehicle data analysis to evaluate pre-crash brake application, wheel impact evaluation

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in a rollover collision – comparison of a simulation and crash test, lateral acceleration through a curve – rear world measurements of normal drivers at the expected higher end, and airbag deployment conditions.

March 2016 *Kelar Pacific, LLC -Autodesk Authorized Training Center – El Segundo*
AutoCAD Fundamentals 2016. Two day course (16 hours)
Topics: The complete explanation of commands and sub-commands, Example-based lectures for each command, Showing application of commands in real-life scenarios of designing and drafting, Use of actual engineering drawings as data files, Lectures about advanced topics like dynamic blocks and sheet sets included, AutoCAD troubleshooting and repairing drawing files tips.

June 2015 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference – Las Vegas, NV*
Topics included: Comparison of actual speed versus calculated speed in low speed pedestrian impacts, unmanned aircraft systems in Public Safety, staying legal when using a drone for scene inspections, an overview of vehicle systems with may impact crash analysis, relating collision trauma biomechanics to crash reconstruction, evaluating motorcycle evasive maneuvers, basic tires mechanics & tire failure analysis, vehicle system digital forensics, reconstructing two-vehicle crash when critical scene data are missing, and vehicle velocity extraction from witness video.

June 2014 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference – Las Vegas, NV*
Topics included: accident reconstruction and biomechanics of low and high-speed collisions, fatigue and human factors, conspicuity and visibility testing and research with reflective tape, and vehicle wheel speed and CDR reported speed differences.

March 2014 *DTS User Training – Seal Beach, CA.* Topics included best measurement practices with DTS DAS and sensors, transducer and bandwidth considerations, filter fundamentals, application showcase and new products.

Dec. 2013 *FARO Laser Scanner LS Training Course (FARO) – Signal Hill, CA*
FARO trainer provided instruction on theory and exercises which enabled users to operate the Focus 3D Scanner and FARO SCENE software. This training prepares users to setup hardware and software for a scanning project, perform the scan, and then import the scan project into the FARO software for data analysis.

5/12-16/2013 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2013*
Topics included: Advancement in Forensic Photography for Crash Investigation, Braking Systems for Passenger Cars and Light Trucks, Differentiating Potentially Causal Pre-crash Component Damage from Crash Damage, Accuracy and Utility of Crash Triggered Video and Data Recorders for Accident Reconstruction, Crush Coefficients Process and Pitfalls, Introduction to Energy-Review, Motorcycle Case Study and New Technology, Further Developments Regarding the Dynamic Modeling of Motor Vehicle Collision Response using the SDOF Approach, How a Large Metropolitan Transit Agency Investigates Collisions (Transit Bus Collision Investigation), and Determination of Vehicle Orientation at Ground Contact for Rollover Accidents.

3/15-16/2013 *Southwestern Association of Technical Accident Investigators (SATAI) Seminar*
Topics included: consumer GPS, traffic enforcement cameras, surveillance cameras, and force balance in accident reconstruction, Toyota EDR Delta V anomalies, post-collision speedometer readings, and forensic seat belt analysis.

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9/28/2012 *Southwestern Association of Technical Accident Investigators (SATAI) Seminar*
Topics included commercial motor vehicle air brake systems, and methods and myths of commercial motor vehicle collision investigations.

6/4-7/2012 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2012*
In addition to full scale crash testing, industry experts spoke on a variety of topics including Hybrid and Electric Vehicle Technology and Its Relationship to EDR Data, Seat Belt Analysis, Reconstruction and biomechanical analysis of Low Speed Collisions, Highway Design, and Using ECM Diagnostic Data in Crash Reconstruction.

3/10/2012 *Southwestern Association of Technical Accident Investigators (SATAI) Seminar*
Topics included: sudden acceleration incidents, data acquisition systems, transportation engineering, and bicycle collision reconstruction.

2/6-9/2012 *ARAS 360*
Advanced three-dimensional computer modeling for accident reconstruction. Topics included getting vehicles to move, adding crush, terrain mapping, exporting animations, and momentum applications.

5/23-26/2011 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2011*
In addition to full scale crash testing, industry experts spoke on a variety of topics including computer aided accident reconstruction and simulation, utilizing global positioning systems (GPS) in accident reconstruction, human factors considerations, effect of aftermarket bumper push-bars on supplemental restraint systems, momentum applications, automobile pedestrian collisions, occupant dynamic simulations, and roadway design.

9/27-29/2010 *National Crash Analysis Conference (NCAC)*
A three-day conference combining full scale testing and technical presentations about current topics in automotive safety. Session topics included: The Role of the National Motor Vehicle Crash Causation Study in Highway related Data Analysis, Sensitivity Study of Vehicle Rollovers to Various Initial Conditions & Jordan Rollover System & Un-Constrained Model Comparison Finite Element Model Based, Influence of NCAP Crash Testing on Passenger Vehicle Design, Rollover Rates and Severity – Dynamic Testing Results, NCAP Rating for Far-side Occupant Protection, Overview of TFHRC & FOIL Federal Highway Administration, Accident Reconstruction Considerations in Rear and Side Impacts, Nature of Narrow Overlap Frontal Collisions: FLEE and FREE, NCAC Overview.

6/16-19/2010 *American Society of Mechanical Engineers (ASME), Summer Bioengineering Conference*
One of the premier Bioengineering conference events of the year. Session topics included: Accident and Injury, Injury Biomechanics, Joint, Spine, Cell and Tissue Transport, Tissue Engineering, Cardiac Mechanics, Biomechanics of Growth and Remodeling, Cardiovascular Design and Devices, Musculoskeletal Engineering, Vascular Mechanics, Mechanical Properties of Musculoskeletal Soft Tissues, Bionanotechnology in Diagnosis and Treatment, Simulation in Human Movement, Biologic Effects on Musculoskeletal Soft Tissues, Structural Mechanics of Bone, Cerebral Aneurysm, and Orthopedic Design and Devices.

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5/24-27/2010 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2010*
Eleven industry experts spoke on various technical topics, including; Devices for Accident Reconstruction Testing, PDOF and Angle Development Over Time, Using Motion Equations in Accident Reconstruction, Automotive Filament Analysis, Conspicuity Issues, Forensic Commercial Motor Vehicle Inspection, Motorcycle Accident Reconstruction, Impact Speed and Post Collision Speedometer Readings, Speed and Acceleration from Video Frames, GPS the Overlooked EDR, and Low Speed Crash Analysis. In addition, this year we held three workshops that focused on using the information obtained during the crash testing and integrating it with real-world accident reconstruction techniques.

4/28-30/2010 *PC-Crash Special 3-day Workshop*
The special 3-day workshop includes an accelerated essentials survey on the first day, followed by two days of advanced special topics. Topics included: •Get it up and running, Starting a project, Get the vehicle to move, Get vehicles to crash, Scenes, Seeing what's going on, 3D vehicles, Suspension, ABS, The trajectory model, 3D scenes, Tire models, 3D collisions, Collision optimizer, Next level animation, Inverse kinematics, The trailer model, The multibody model – Theory, Multibody pedestrians, The rollover model (a multibody vehicle), Exporting data using DDE – getpccrashdata.xls.

11/6-7/2009 *Southwestern Association of Technical Accident Investigators (SATAI)*
Training course in aftermarket components and the EDR, EDR discrepancies, stiffness data research and calculations, experts and lawyers in the courtroom.

6/1-4/2009 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2009*
Industry experts spoke on various technical topics including; Death Investigation and Their Psychological Effect on the Police Officers, Estimations of Vehicle Speed and Trajectory Based on Video from a Vehicle-Mounted Camera, Commercial Vehicle Dynamics, Evaluation of Driver Response at Night, Optics, Lighting and Visibility for the Forensic Investigator, Using Critical Speed Formula on Yaw Marks Leading to Rollover, Air Brake Basics, Braking Efficiencies of Motorcycles by Experienced Riders, Practical Applications of Accelerometer data, and Commercial Vehicle Air Brake Performance.

5/1-3/2009 *Photomodeler Collision Investigation*
Three-day course that covered a wide range of topics such as proper planning and photography methods, using the basic tools, export and measure, camera calibration, standard procedures for field work, using advanced tools, and working with complex projects.

8/5-9/2008 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2008*
Topics covered include: New Vehicle Technologies and Their Relationship to Proper Crash Reconstruction Techniques, Close-Range Photogrammetry as a Routine Accident Reconstruction Tool, Judkin's Law and Its Application to Human Factors of Collision Avoidance and Witness Recall, Motorcycle Crash Analysis, Pedestrian Crash Analysis and Excel Program Workshop, Current Trends in Pedestrian Crash Analysis, Video Applications in Crash Reconstruction, Rollover Workshop, Airborne Analysis and Rotational Mechanics, Momentum and Energy, and Reconstruction of PIT Crashes.

1/20-22/2008 *World Congress of Neck pain 2008*
Present the latest scientific research and findings of evidence-based systematic reviews, on the cause, prevention, diagnosis, treatment and societal impact of neck pain and associated functional disability. The Program Format includes plenary, break-out sessions, panels, poster sessions, question and answer sessions. Jointly sponsored by

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the Canadian Institute for the Relief of Pain and Disability and the American College of Occupational and Environmental Medicine.

6/4-7/2007 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2007*
Topics covered include: Accelerometer Sampling Rates, Two Vehicles In-Three Pieces Out, Airbag Related Injuries, Angular Velocity Analysis of SUV Collisions Using PC Crash, Low Speed Crash Tests, European Reconstruction Techniques, Factors impacting Pre-Crash Data, Hit & Run-Closing the Loop, Human Factors-Beyond Perception Reaction Time, Investigating Nighttime Pedestrian Collisions, Investigating Snowmobile Crashes, Seat Belts, and Traffic Reconstruction at Traffic Signal Intersections.

3/1-3/2007 *Cedars-Sinai Medical Center Institute for Spinal Disorders – Sixth Annual Symposium on Current Concepts in Spinal Disorders 2007*
Topics covered included: surgical indications for interventional injections, therapeutic nerve blocks, discography, multimode intrasurgical imaging of the spine, biology of disc repair (BMP-2, BMP-7, GDF-5), biology and clinical relevance of the nucleus pulposus, stem cell based spinal fusion, biomechanics of artificial disc replacement (ADR) versus fusion (lumbar, cervical, crosslinking, biomechanics of non-fusion devices, imaging based spine biomechanics), lumbar total disc (TDR) replacement clinical data, motion preservation, deformities, cervical TDR, posterior non-fusion technologies, and innovative technologies.

6/5-8/2006 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2006*
Topics covered included: Lower extremity injuries, collision speed analysis of angular collisions involving secondary impacts, simulations, motorcycle brakes, braking tests and sources of information, rollover tests of a 1991 Ford Explorer, crash data retrieval-legal brief, pictometry in crash scene mapping, deceleration rates for modern vehicles, principle direction of force, vehicle dynamics resulting from curb impacts.

3/31/2006 – 4/1/2006 *The Essential Soft Tissue Injury Conference*
Topics covered included: The latest research on injury thresholds: The death of the low velocity impact defense, the biomechanics of whiplash: the latest evidence surrounding soft tissue injuries, orofascial pain, the sacroiliac join, causes, consequences and treatment of labral and rotator cuff injury, traumatic brain injury, neuroimaging, and centrally mediated pain and patient/client with no objective findings.

2/27/2006 *Diversified Technical Systems (DTS) Principles of Dynamic Data Collection*
Data Collection Fundamentals, Sensors, Noise Reduction, Grounding and Shielding, Data Analysis and Trouble Shooting.

2/13-14/2006 *Crash Data Retrieval User's Conference*
Topics covered at the conference included: Vetronix CDR system updated, CDR as a tool for intelligent transportation systems and human factors issues, A review of various ACM module types and data recorded, motorcycle collisions involving motor vehicles equipped with event data recorders, Analysis of the GM SDM in 360 degree linear momentum collisions-Real Case Analysis, CDR presentation and validation in legal proceedings, Legal implications of data collection, investigation into the durability of ACM, quantifying uncertainties in Ford and GM event data recorders, the accuracy of speed recorded by an SDM and the effects of brake and yaw events, overview of the new GM modules using CAN bus technology , and practical applications for CDR gathered CAN bus data.

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2/2-4/2006 *Cedars-Sinai Medical Center Institute for Spinal Disorders-Fifth Annual Symposium on Current Concepts in Spinal Disorders 2006*
Topics covered at the conference included: cervical artificial disc replacement, spine centers of excellence, disc repair, gene therapy, nucleus replacement, collagen crosslinking, stem cell based biological disc, posterior non-fusion instruments, lumbar artificial disc replacement, selection criteria, complications, minimally invasive surgery, cervical plate design, and thoracic screws for deformity.

6/6-10/2005 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2005, Presenter*
Topics covered at the conference included: Human Factors, Independent Witness System, Airbag Deployment Thresholds, Commercial Vehicle EDR data, Using Crash Data, Commercial Vehicle Crashes, Damage and Energy Concepts, Child Safety Seats, Pedestrian Crash Analysis, and Pedestrian Crash Injuries.

6/21-25/2004 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2004*
Topics covered at the conference included: EDR data in Criminal Prosecution, Crash Data Retrial System Update, Crush Measuring Protocol, Commercial Vehicle Event Data Recorders, Crash Testing – A Historical Perspective, A Comparison of Crush Stiffness Characteristics from Partial –Overlap and Full-Overlap Frontal Crash Tests, A Method for Determining Crush Stiffness Coefficients from Partial-Overlap Frontal Crash Tests, and LTI Laser and Pocket Zone Crush Measurements.

8/11-12/2003 *Crash Data Retrieval System Operator's Certification Course, Collision Safety Institute*
Provided the CDR system end user with the skills and information to effectively download data from an automobile event data recorder and understand the meaning of the information provided through the software.

6/8-12/2003 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2003, Presenter*
Topics covered at the conference included: Low Speed Collisions – Analysis and Biomechanics, Collision Trauma Biomechanics, Airborne Events – Analysis and modeling, Commercial Vehicle Event Data Recorders, New Version CDR System – GM and Ford, Field Data Review and Data Distribution, NHTSA Crash Data – Problems in Obtaining and Using, and Vehicle Crush Analysis.

4/28/2003 – 5/2/2003 *Special Problems in Traffic Crash Reconstruction, Institute of Police Technology and Management (IPTM), Presenter at Breakout Sessions*
Topics covered at the conference included motorcycle brake testing, validation of vehicle spin model, rotational mechanics in traffic crash reconstruction, geometric roadway design, three-point trajectory analysis, motorcycle impact friction values, occupant kinematics (biomechanics), photogrammetry, NHTSA crash test data errors, pedestrian amputation and speed association, rollovers, and variability in human form.

8/2002 – 12/2002 *Principles of Epidemiology, Department of Preventive Medicine Biostatistics Division, USC School of Medicine*
Terminology and uses of epidemiology and demography; sources and uses of population data, types of epidemiological studies, risk assessment; common sources of bias in population studies; principles of screening.

NOT FOR EXPERT DESIGNATION

8/18-21/2002 *ARC Network & Collision Safety Institute (ARC-CSI) Crash Conference 2002, Presenter*
Three-day crash conference that included instrumented crash tests. Lecture subjects included rollover reconstruction, human surrogates for crash testing, rollover biomechanics, accelerometer systems, advanced vehicle safety, EDR update, examination of the Susan Smith case, underwater investigations, rollover simulations, vehicle design and rollover, and a review of crash test data.

5/13-15/2002 *McHenry Software Training 2000*
Three-day training seminar including hands on training in the use of M-Edit, M-SMAC and other McHenry software utilities. List of topics included: history, background, RICSAC validations, other validations, creating the basis for admission to court, SNAG-Impulsive restraints, tire cornering stiffness, center of collision interface, SMACO – simplified occupant model, SMACTHP – to determine speed change at any occupant location, steer degrees of freedom, path follower driver model, and creating what if scenarios.

1/2002 – 5/2002 *Principles of Biostatistics, Department of Preventive Medicine Biostatistics Division, USC School of Medicine*
Concepts of biostatics; appropriate uses and common misuses of health statistics; practice in the application of statistical procedures; introduction to statistical software including EXCEL and SPSS. Included laboratory.

8/2001 – 12/2001 *Seminar in Bioengineering, Department of Biomedical Engineering, USC*
Presentation of current research in Biomedical Engineering.

8/1-2/2001 *Advances in Side Impact Test Methodologies and Occupant Protection TOPTEC, Society of Automotive Engineers*
A two-day TOPical, TEChnical workshop where researchers from various disciplines provided insight into the problems associated with injuries from side impact collision. The objectives were to gain insight into new injury criteria for side impact injuries, contrast the different side impact test methodologies, learn about current and future side impact and occupant protection advancements, compare various dummies used for side impact analysis, interface with an international panel of experts, analyze the effects that new developments have on side impact passenger injuries, understand the relationship between side impact and subsequent occupant injuries, learn how and why various side impact test methodologies were developed, compare the different ways countries evaluate side impact crashes, learn state of the art occupant protection countermeasures, and understand what emerging issues will influence future vehicle design.

6/30/2000 *CDR (Crash Data Retrieval system) 2000 Training Seminar, Vetronix Corporation*
A one-day training class providing an overview of Vetronix, an overview of the CDR systems, methods to access data, software tips, history of SDM (Sensory Diagnostic Modules), SDM data overview, SDM data parameters and their limitations, field training and demonstration of downloading the data from vehicles.

1/27-28/2000 *Lower Extremity Injuries TOPTEC, Society of Automotive Engineers*
A two-day TOPical, TEChnical workshop that helped safety professionals understand the significance of lower limb injuries in the field and their injury mechanisms. Expert presenters reviewed the status of new test dummies that are being developed and compared the various safety countermeasures. The objectives were to understand the biomechanics of the foot, ankle, leg, knee, thigh and pelvis; understand the injury mechanisms in various crash modes; receive an overview of new dummy development and global regulations; and compare various safety countermeasures and understand how they might mitigate injuries.

NOT FOR EXPERT DESIGNATION

12/9-10/1999 *Frontal Offset Crash Testing TOPTEC, Society of Automotive Engineers*
A two-day TOPical, TEChnical workshop that examined the current offset tests and the differences between the various international crash tests. Presenters provided an overview of the problem of occupant protection in offset crashes. The history and current status of frontal offset crash testing was reviewed. The objectives were to understand the nature and severity of frontal offset crashes; gain new insight into the current role of offset crash testing; and gain awareness of the relationship of frontal offset crash protection to the growing public concern regarding vehicle compatibility.

12/9-10/1999 *Accident Reconstruction: State-of-the-Art TOPTEC, Society of Automotive Engineers, Presenter*
A two-day TOPical, TEChnical workshop presenting the latest developments and ongoing research in accident reconstruction. Topics included collision analysis, reconstruction techniques, collision performance, computer simulation and modeling, research, and testing.

10/25-27/1999 *43rd STAPP Car Crash Conference*
The premier forum for presentation of research in impact biomechanics, human injury tolerance and related fields that advance the knowledge of crash injury protection. Papers presented grouped by topic into Current and Future Crashworthiness Priorities, Side Impact, Lower Limb Biomechanics, Spinal Biomechanics, Brain Injury, Upper Extremity Biomechanics and Airbag Side Effects.

2/8-11/1999 *World Congress on Whiplash-Associated Disorders, Physical Medicine Research Foundation – Presenter*
Disseminated the latest research on traffic safety and auto-engineering including issues such as crash prevention, traffic safety and education, injury prevention/reduction, automobile safety and design, crash dynamics and injury exposure. Disseminated the latest research on the diagnosis and treatment of whiplash-associated disorders including issues such as the evaluation of diagnosis and treatment programs, medical intervention, physical therapies, treatment modalities, exercise and interdisciplinary approaches, prognostic indicators and prevention of chronicity.

11/2-4/1998 *42nd STAPP Car Crash Conference*
The premier forum for presentation of research in impact biomechanics, human injury tolerance and related fields that advance the knowledge of crash injury protection. Papers presented on topics addressing biomechanics of injury to the upper and lower extremities; head and neck response and injury mechanisms; new insights on occupant protection from safety research in motorsports; improvements in occupant-protection systems; and the development of new crash dummies, human models, and test procedures for occupant injury assessment in simulated crashes.

7/13-16/1998 *International Association of Accident Reconstruction Specialists 1998 Conference*
Topics covered included the role of the accident reconstruction expert in the legal system, biomechanics of low-speed impacts, low-velocity/insurance fraud, elderly driving issues, issues of driver awareness and traffic control devices, transfer and trace evidence in traffic accident investigation, blood evidence in accident reconstruction, and tire dynamics and nomenclature.

11/13-14/1997 *41St STAPP Car Crash Conference*
The premier forum for presentation of research in impact biomechanics, human injury tolerance and related fields that advance the knowledge of crash injury protection. Papers presented on topics addressing the biomechanics of child injuries, and injuries in side, frontal, rear and rollover impacts. Human impact responses from the head to the lower extremities are reported.

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8/1997 – 12/1997 *Experimental Projects in Biomedical Engineering, Department of Biomedical Engineering, USC*
Application of modern instrumentation and data processing techniques to the experimental study of selected biosystems. Laboratory.

3/24-28/1997 *Crash '97 Conference on Reconstruction and Safety on the Highway, Texas Engineering Extension Services (TEES)*
Topics covered included commercial vehicle involved in underride collisions, commercial vehicle collision investigation, system-based energy momentum, human subject testing and response to low-level accelerations, nighttime vision and reaction time, when the coefficient of restitution approaches "1", rollover accidents, demonstrative evidence, water-related traffic accidents, a brief introduction to vectors, commercial motor vehicle driver fatigue and alertness study, and forensic animation computer-based training.

3/20-22/1997 *T.A.A.R.S. - S.O.A.R. - W.A.T.A.I. Combined Conference*
Topics presented included the practical application of biomechanics towards motor vehicle crash trauma, tractor truck/semi-trailer underride accidents, investigation of safety protocols with inflatable safety restraint systems, bloodborne pathogens, and human subject and biomechanical responses to low-speed impacts.

1/1997 – 5/1997 *Biomechanics of Injury, Department of Biomedical Engineering, USC*
Lectures on the specific mechanical and biomechanical properties of involved human tissues to determine injury patterns and injury criteria. Case studies were utilized from such areas as automobile and sports accidents. Specifics involved taking a set of medical records regarding a given injury and determining the amount and type of force necessary to cause the injury pattern. Course content included mechanics of bone, the skull and brain, the cervical and lumbar spine, the upper extremities, the lower extremities and mechanics of soft tissue.

1/1997 – 5/1997 *Seminar in Bioengineering, Department of Biomedical Engineering, USC*
Presentation of current research in Biomedical Engineering.

11/4-6/1996 *40th STAPP Car Crash Conference*
The premier forum for presentation of research in impact biomechanics, human injury tolerance and related fields that advance the knowledge of crash injury protection. Papers presented on topics including side impact injuries and testing, pelvis injuries, age effects on thoracic injury, lower extremities injuries (patellofemoral, knee, foot, ankle), mathematical models, human subject response to rear-end collisions, and accidents involving children and child restraints.

8/1996 – 12/1996 *Biomechanics, Department of Biomedical Engineering, USC*
Mechanical properties of biological tissues and fluid transport in physiological systems: blood, rheology, bioviscoelastic solids and fluids; gas flow and mixing; and prosthetic design.

8/1996 – 12/1996 *Seminar in Bioengineering, Department of Biomedical Engineering, USC*
Presentation of current research in Biomedical Engineering.

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8/19-20/1996 *Low-Speed Rear-Impact Collision TOPTEC, SAE – Presenter*
A two-day topical, technical workshop (TOPTEC) presenting the latest research in assessing low-speed impact severity and occupant kinematic analysis. Topics covered included biomechanics of soft tissue injuries, understanding "whiplash," human volunteer testing, human subject responses, structures and injuries of the neck, dummy development, seat testing, experimental neck injury research, comparison of different cars seats regarding head-neck kinematics, reconstructing minor collisions, and low-speed vehicle impact demonstration.

1/1996 – 5/1996 *Advanced Studies of the Nervous System, Department of Biomedical Engineering, USC*
Advanced topics on the structure and function of the nervous system examined from the viewpoint of computational systems science.

1/1996 – 5/1996 *Advanced Topics in Biomedical Systems, Department of Biomedical Engineering, USC*
Advanced topics in selected biomedical systems: cell membrane transport and electrophysiological approaches; skeletal muscle physiology, adaptation of skeletal muscle to endurance training, effects of aging on the neuromuscular system and cellular mechanisms of skeletal muscle fatigue and muscle pain; auditory physiology, vestibular physiology; vestibulo-ocular reflex; and respiratory physiology.

8/1995 – 12/1995 *Mathematical Biophysics, Department of Biomedical Engineering, USC*
Formulation of biological problems in mathematical terms. Analytical and computational solution of the relevant equations.

11/11-12/1995 *Accidental Injury: Biomechanics and Prevention, UCSD School of Medicine*
A state-of-the-art review of the biomechanics of human injury. Emphasis was placed upon human tolerance, mechanisms of injury to anatomic areas and contemporary techniques of injury prevention.

11/8-10/1995 *39th STAPP Car Crash Conference*
The premier forum for presentation of research in impact biomechanics, human injury tolerance and related fields that advance the knowledge of crash injury protection. Papers presented on topics addressing airbag effectiveness and airbag injury patterns, frontal impact tolerance, rollovers, brain injury, biomechanics of the face, cervical spine biomechanics, properties of skeletal muscle and its relevance to human cervical spine impact dynamics, low speed rear-end collisions, shear and bending response of the knee joint to lateral impact, effects of age on fracture tolerance of the patellofemoral joint, and side impact crash test dummy biofidelity.

8/3-4/1995 *Automotive Seat Design for Safety TOPTEC, SAE*
A two-day topical, technical workshop presenting the latest developments on safety in automotive seat design. Topics included designing for ergonomics and manufacturing, safety seat concepts, real world collision performance, testing, regulatory issues and advanced concepts.

7/21-22/1995 *Southwest Association of Traffic Accident Investigators, Low-Speed Seminar*
Seminar provided an understanding of the mechanics of low speed rear-end collisions. Numerous low-speed rear-end, vehicle-to-vehicle, collisions were performed. Vehicle contact components were viewed. Selected occupant (human volunteer) kinematics and acceleration data collected during low speed rear-end impacts were reviewed. A sideswipe and a broadside collision were also performed.

1/1995 – *Seminar in Biomechanics, Department of Biomedical Engineering, USC*

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5/1995 Biomechanical analysis of the human spinal column. Variations in the anatomical structures were investigated as they related to mechanical stability, structural rigidity and dynamic performance. Current research into developing mathematical and computer models of the spine was reviewed.

1/1995 – 5/1995 *Measurement and Processing of Biological Signals, Department of Biomedical Engineering, USC*
Acquisition, analysis and display of biological data using digital computers: laboratory applications of digital signal processing and real time analysis.

8/1994 – 12/1994 *Signal and System Analysis in Biomedical Engineering, Department of Biomedical Engineering, USC*
Classification; representation; statistical analysis; orthogonal expressions; least squares estimation; harmonic analysis; Fourier, Laplace and Z-transforms; the linear system; filtering; modeling and simulation; and linear control theory.

8/6-8/1994 *Low-Speed Rear-Impact Collision TOPTEC, SAE – Presenter*
A two-day topical, technical workshop presenting the latest research in the area of rear-impact frequency and resulting injuries. Topics covered included accident reconstruction, occupant kinematics, kinematics of occupant response, cervical injuries, crash severity and injury frequency, current research in rear- impact collisions, and staged collisions: role of bumpers, estimating impact severity and injury potential. Smaller working groups focused on crash severity, legal ramifications, and accident reconstruction.

9/1993 – 5/1994 *Gross Human Anatomy A and B, Department of Anatomy and Cell Biology, USC School of Medicine*
A complete dissection of the adult human body with supplementary lectures and demonstrations. Emphasis on correlating development, structure and function. Additional areas of study included interpretation of x-rays, cross-sectional anatomy and identification of functional deficiencies through practical case studies.

12/8-10/1993 *Head and Neck Injury Symposium, Automotive Engineers continuing professional development group and The Safety Advisory Panel*
Topics of discussion included anatomy of the head and neck, macro and microscopic brain injury, biomechanics of brain injury, clinical aspects of central nervous system trauma, psychological effects of central nervous system trauma, facial trauma, helmet performance and test requirements, closed head injuries, biomechanics of neck injury, anterior neck injuries, musculoskeletal injuries of the cervical spine, prevention of head and neck injuries, and costs of head and neck trauma.

7/16-18/1993 *Biomechanics of Injury, The University of Northern California*
Instruction on the fundamentals of injury causation, specifically covering injuries of the head, neck, spine, brain, face, abdomen, cardiovascular system and extremities. Biomechanical issues related to roof crush, passive restraints, comfort features, seat belt effectiveness, airbag injuries and low velocity injuries were covered.

4/1993 *Technical Workshop: Skids and Collisions, the San Bernardino County Sheriff Emergency Vehicle Operations Center and Government Employee's Insurance Company - Co-sponsor*
Workshop included vehicle skid and handling tests on wet and dry surfaces, centrifugal skids, commercial vehicle (semi-trucks) skid performance, motorcycle skid performance and low velocity car-to-car impacts.

1/18-22/1993 *Engineering Dynamics Corporation Simulations Seminar*
One-week intensive seminar on the use of EDVAP software for simulating motor vehicle accidents. Thorough examination of tire models, collision models, estimating initial conditions, driver input tables and evaluation of case studies.

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8/12-14/1992 *BH_2VK Crash Testing Seminar, Mobility Systems and Equipment Co.*
Experimental collision research to gain knowledge about the relationship between energy of approach and residual crush for eventual reconstruction purposes. Fixed-barrier impact tests at 15, 20, 40 and 50 mph were observed and analyzed, as well as a 40 mph vehicle-to-vehicle test. Standard accident reconstruction methodologies were applied to predict impact speeds and residual crush. These values were correlated with actual tests and crush data.

6/1992 – 7/1992 *Structural Biomechanics, California State University, Northridge*
Functional anatomy of the human body with emphasis on biomechanical laws and their application in analysis of movement activities.

11/16-17/1991 *Accidental Injury: Biomechanics and Prevention, UCSD School of Medicine and the Institute for Medical Education and Research*
A presentation of anatomy, injury mechanics and tolerance of the human head and spine, occupant kinematics, restraint systems effectiveness and occupant compartment integrity

10/1-2/1991 *Biomechanics of Impact Trauma, Association for the Advancement of Automotive Medicine*
Analysis of different injury types and mechanisms associated with automobile accidents. Topics covered included: biomechanics, occupant kinematics and crash severity assessment; crash injury and impairment assessment; injury types, mechanisms, tolerance criteria and limits of the skull, brain, cervical spine, extremities and pelvis; biomechanical evaluation of helmet standards; biomechanics of thoracic injury; biomechanical evaluation of seat belt use and occupant restraint technology; clinical aspects of lower limb injuries for motorcyclists and pedestrians; and crash performance standards integrated with biomechanical knowledge.

2/1991 – 6/1991 *General Human Anatomy, Santa Monica College*
An intensive study of the structure of the human body. Major consideration was given to tissue structure and the skeletal, muscular, circulatory, respiratory, digestive, excretory, reproductive, integumentary and nervous systems.

12/10/1990 *Vehicle Control Course, Willow Springs International Driving School*
Basic techniques of vehicle control including proper braking techniques, skid performance and vehicle response to improper driver input.

12/1-2/1990 *Anatomy for Attorneys, Medi-Legal Institute*
Examination of traumatic injuries and degenerative conditions, anatomical structure of the vertebral column, mechanisms of injury to the cervical spine, head injury and proximate causes, and injuries and fractures of the limbs.

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RESEARCH AND TESTING

Jan. 2024 Performed and participated in a series of eight low speed rear-end impacts between an instrumented bullet Toyota Corolla and target Kia Rio, with a male human volunteer and Hybrid III 50th percentile male ATD in the bullet Corolla and instrumented humans and BioRID II ATD in the target Rio. Official SATAI tests were four high-speed motorcycle-to-sedan impacts utilizing instrumented vehicles, and ATDs, which included: a broadside impact between a Suzuki GSX-R750 and a moving Honda Civic target, a broadside impact between a Yamaha YZF-R1 and a moving Honda Civic target, a broadside impact between a Kawasaki Versys 650 and a moving Honda Civic target, and an angled frontal impact between a Kawasaki Versys 650 and a stationary Honda Civic target. Vehicle dynamics, vehicle damage, EDR data, and dummy occupants motions/loading were documented and analyzed.

Results presented at SATAI Conference, January 3-6, 2024, Glendale, AZ

March. 2023 Performed and participated in a series of six instrumented low speed rear-end impacts between a bullet Honda Civic and a target Ford Focus, with instrumented human driver and 50th percentile male Hybrid III and BioRID ATDs in the target vehicle and three human occupants in the bullet vehicle. Performed and participated in official SATAI conference crash tests utilizing instrumented vehicles, human volunteers, and ATDs, which included: high-speed remote-driven Ford Escape to ATD pedestrian impact; high speed remote-driven 50% frontal offset between a Ford Escape and Chevrolet Impala; a lane change side-swipe between a Subaru Outback and a Mazda 5; a T-swipe between a Subaru Outback front bumper and Mazda 5 side; a narrow offset angled collision between the right front of a Mazda 5 and the left front of a Subaru Outback; an impact between the right front of a Subaru Outback and the partially open Mazda 5 driver's door. Vehicle dynamics, vehicle damage, EDR data, and human/dummy occupants motions/loading were documented and analyzed. Pre and post full-body MRI scans were conducted on the instrumented human driver in the low speed rear-end tests. All tests were performed in Glendale, AZ.

Results presented at SATAI Conference, March 1-4, 2023, Glendale, AZ

Feb. 2022 Performed and participated in front-to-barrier, rear-to-barrier, and rear end impacts with instrumented volunteers using a Civic and Outback with analysis of EDR data/triggering thresholds, an offset rear-end impact with wheel-wheel engagement between two Civics, a side-swipe between a Corolla and Civic with wheel-snagging, in-line rear-end impacts using Impalas with moving and stationary target vehicles, and an angled broadside between an Impala and a Corolla. Human volunteers and ATDs were utilized. All tests were performed in Glendale, AZ.

Results presented at SATAI Conference, February 17-20, 2022, Glendale, AZ

Feb 2022 Performed and participated in head drop tests onto a steering wheel. Dropped a Hybrid III ATD head onto a steering wheel from a 1959 Mercedes at various impact speeds and recorded acceleration and HIC.

Nov. 2021 Performed and participated in a series of 12 tests to quantify the head accelerations (linear and angular) and neck forces associated with a Tesla Model X Falcon Wing doors closing on an occupant. A series of 10 tests were conducted with an instructed Hybrid III 5th Percentile Female Anthropomorphic Test Device (ATD). Test were conducted at various locations around the door. Two additional tests were conducted with the Falcon Wing doors contacting a load cell with ATD skin on the load cell.

NOT FOR EXPERT DESIGNATION

Jan. 2021 Performed and participated in a series of twelve three-vehicle chain-reaction rear end collisions between an instrumented Chevrolet Sonic, instrumented Hyundai Elantra, and a Ford Thunderbird. Tests were conducted with and without pre-impact braking by the bullet vehicles. Two angled frontal collision and two angled broadside collisions between the Chevrolet Sonic and Hyundai Elantra were also conducted. All tests included live human volunteers operating the moving vehicles, and I acted as the volunteer in nine tests including one with front and knee airbag deployments. Vehicle motions, EDR data, and occupant motions were recorded. All tests were performed in Glendale, AZ as part of the SATAI Crash Conference.

May 2019 Performed and participated in a series of four instrumented head impact tests utilizing a free motion head form (Anthropomorphic Test Device (ATD) impacting a driver's front passenger seat from a 2006 Honda Pilot. These impacts were conducted at impact speeds of the head from 4 to 9.6 mph. Head liner and angular accelerations (rate) were measured.

Mar-April 2019 Performed and participated in a series of six instrumented head impact tests utilizing a free motion head form (Anthropomorphic Test Device (ATD) impacting a driver's front passenger seat from a 2009 Toyota Camry. These impacts were conducted at impact speeds of the head from 8.2 to 10.1 mph. Head liner and angular accelerations (rate) were measured.

March 2019 Performed and participated in three tests to quantify the force required to fold in the passenger side mirror of a 2016 Tesla Model S. Pull tests were conducted with an inline load cell.

March 2019 Performed and participated in a series of eight tests in which a weight was dropped from various heights and at various locations onto a fully instrumented Hybrid III (Anthropomorphic Test Device (ATD). The ATD was equipped with sensors to quantify the head linear and angular accelerations, upper neck load cells and moments, thoracic accelerations, and lumbar forces and moments. Testing was conducted to simulate a piece of a microscope impacting a patient's head.

Sept. 2018 Performed velocity and acceleration analysis of a container crane. A container (dockside ship-to-shore) crane was equipped with a Video VBOX. Crane speed was tested at 100% throttle forward, 50% throttle forward, 100% throttle reverse and 50% throttle reverse. There tests were conducted at the Port of Long Beach.

April 2018 Performed and participated in a series of four instrumented head impact tests utilizing a free motion head form (Anthropomorphic Test Device (ATD) impacting a driver's front passenger seat from a 2012 Ford Explorer XLT. These impacts were conducted at impact speeds of the head from 6 to 9 mph. Head liner and angular accelerations (rate) were measured.

March 2018 Performed and participated in a series of low speed broadside impacts at various angles between Camrys and a Corolla. Instrumented human volunteers and Hybrid III test dummies were utilized in both the bullet and target vehicles. High-speed video analysis was conducted from multiple angles. Vehicle dynamics, vehicle damage analysis, EDR data, and human/dummy occupant kinematics were documented and analyzed. All tests were performed in Las Vegas, NV.

Results presented at SAE World Congress, April 10, 2019, Detroit, MI

NOT FOR EXPERT DESIGNATION

Sept. 2017 Performed and participated in a series of vehicles-to-pedestrian dummy impacts. Various instrumented vehicles and instrumented pedestrian dummy types were utilized. Vehicle damage patterns, pedestrian dummy throw distance and trajectory, and vehicle/dummy accelerations were investigated. Performed and participated in a series of low-speed bumper to trailer hitch impact on an instrumented Toyota Corolla and Nissan Frontier. Vehicle damage and dynamics were investigated. Performed and participated in a high-speed broadside impact with a remote-driven Dodge Dart and a Cadillac SRX, a 3-car impact sequence were a Chevrolet Impala rear-ended a Pontiac Solstice with the Pontiac subsequently broadsided by a Cadillac Deville, a 3-car chain-reaction rear-end impact sequence with a Ford Escape rear-ending a Toyota Corolla which was pushed into the rear of a Ford 500, a high-speed head-on collision between two remote-driven Ford Escapes, and human volunteer kicking of side panels of a Chevrolet Cavalier. All tests were performed at the Las Vegas Motor Speedway, Nevada.

Results presented at ARC-CSI Conference, September 17-21, 2017, Las Vegas, NV

Sept. 2017 Performed and participated in three high speed tests to quantify the forces associated with a mirror from a 2014 Dodge Ram pickup impacting the head of a pedestrian at speeds between 25.3 and 35.2 mph. The mirror impacted the rear of an instrumented Hybrid III 5th percentile Anthropomorphic Test Device (ATD). The ATD was instrumented with sensors to measure linear and angular acceleration (rate).

Jul. 2017 Performed and participated in head drop tests onto a rubberized surface. Dropped a Hybrid III ATD head onto a children's playground and recorded acceleration and HIC in different areas of the playground, in different orientations and at different heights.

March 2017 Performed and participated in a series of varying height head drop impacts into a Ford F350 pickup head restraint. An instrumented Hybrid III dummy head was utilized. Head accelerations and HIC were analyzed. All tests were performed in Signal Hill, CA.

Feb. 2017 Performed and participated in a series of varying severity low-speed head impacts with a glass door. A human volunteer and an instrumented Hybrid III dummy were utilized. Human volunteer kinematics as well as dummy motions, head accelerations, and cervical loads were analyzed. All tests were performed in Los Angeles, CA.

Sept. 2016 Performed and participated in quasi-static and impact testing of a 2012 Volvo S60 sedan's side mirror. Quasi-static pull testing to determine deflection force was conducted. Impact testing between the side mirror and an instrumented Hybrid III Dummy at increasing speeds were conducted to analyze head accelerations, as well as cervical and lumbar loads and moments. All tests were performed in Signal Hill, California.

May 2016 Performed and participated in a series of motorcycle to flat barrier and motorcycle to vehicle impacts, a remote-driven VW Passat head-on collision with a remote-driven Ford Crown Victoria, a human-driven Ford Crown Victoria into the side of a reversing Toyota Prius collision, a remote-driven high-speed VW Passat to flat barrier impact, a 3-car chain-reaction rear-end impact sequence with a human-driven Ford Crown Victoria colliding into the rear of a remote-driven VW Passat which then struck a Chevrolet Cavalier, and a high-speed angled remote-driven VW Passat left front to barrier impact. All tests were performed at the Las Vegas Motor Speedway, Nevada.

Results presented at ARC-CSI Conference, May 23-26, 2016, Las Vegas, NV

May 2016 Performed and participated in a series of low-speed rear-end and head-on frontal impacts between an instrumented Toyota Prius and VW Passat, both with human volunteers and a hybrid III dummy in the VW Passat's right front seat. Two VW Passat front to flat barrier impacts were conducted with a human volunteer driver and a Hybrid III Dummy in the right front seat. All tests were performed at the Las Vegas Motor Speedway, Nevada.

NOT FOR EXPERT DESIGNATION

Nov. 2015 Performed and participated in instrumented Hybrid III dummy head strikes from a hospital pump. Dummy neck loads and moments, head accelerations and angular velocities, and HIC were analyzed. All tests were performed in Los Angeles, California.

Nov. 2015 Performed and participated in instrumented Hybrid III dummy head form strikes with a Toyota Sienna head restraint. Dummy head accelerations and angular velocities, and HIC were analyzed. All tests were performed in Signal Hill, California.

June 2015 Performed and participated in instrumented Hybrid III dummy head strikes from a Toyota Sienna liftgate. Dummy neck loads and moments, head accelerations and angular velocities, and HIC were analyzed. All tests were performed in Signal Hill, California.

June 2015 Performed and participated in a human-driven Land Rover Discovery II with instrumented Hybrid III dummy high speed broadside impact into a Lincoln MKZ, a remote-driven motorcycle broadside impact into a Dodge Grand Caravan, a remote-driven motorcycle high speed broadside impact into a Ford Crown Victoria containing a human driver, a human-driven Chevrolet Malibu with human front passenger high speed vault off a ramp and then broadside impact into a Mazda3, a human-driven Dodge Grand Caravan with instrumented Hybrid III dummy high speed vault off a ramp and then oblique frontal impact into a Hyundai Elantra, a remote-driven motorcycle high speed broadside impact into a Ford Crown Victoria, a remote-driven Pontiac Grand Prix high speed offset frontal impact with a remote-driven Ford Crown Victoria, a human-driven Mazda3 high speed offset frontal impact with a wheel/tire, and two human-driven Ford Crown Victoria with instrumented Hybrid III dummy narrow overlap head-on impacts into a Dodge Grand Caravan. All tests were performed at the Las Vegas Motor Speedway, Nevada.

Results presented at ARC-CSI Conference, June 1-4, 2015, Las Vegas, NV

May 2015 Performed and participated in a series of increasing severity low-speed rear-end impacts between an instrumented 2005 Mazda3 and the trailer hitch of a 2001 Land Rover Discovery II. The bullet vehicle utilized an instrumented human volunteer driver and an instrumented Hybrid III dummy in the right front seat. The target vehicle utilized an instrumented human volunteer driver. All tests were performed at the Las Vegas Motor Speedway, Nevada.

May 2015 Performed and participated in low-speed rear-end impacts between an instrumented 2005 Mazda3 and a 2007 Toyota Yaris. The bullet vehicle utilized an instrumented human volunteer driver and an instrumented Hybrid III dummy in the right front seat. The target vehicle utilized a human volunteer driver. All tests were performed at the Las Vegas Motor Speedway, Nevada.

May 2015 Performed and participated in instrumented Hybrid III dummy head strikes from a metal weather cap. Dummy neck loads and moments, head accelerations and angular velocities, and HIC were analyzed. All tests were performed in Signal Hill, California.

Oct. 2014 Performed and participated in an amusement park roller coaster testing utilizing an instrumented 50th percentile male Hybrid III anthropomorphic dummy and human volunteers. Roller coaster accelerations, dummy cervical and lumbar loads and moments, as well as dummy head, thorax, and lumbar accelerations were measured and analyzed. A total of 5 tests were conducted in Ontario, California.

NOT FOR EXPERT DESIGNATION

June 2014 Performed and participated in a remote-driven Ford Explorer high speed frontal barrier impact, two Chevrolet Cobalt high speed offset frontal impacts (with remote controlled ignition switch position), a remote-driven Ford Contour high speed impact into a New Flyer city bus containing an instrumented Hybrid III anthropomorphic dummy driver and instrumented human passengers, a high speed head-on collision between two remote-driven Ford Crown Victoria sedans, human-driven Toyota Prius front and rear barrier impacts, human-driven Chevrolet Cobalt front and rear barrier impacts, multiple rear-end and frontal impacts between human driven Toyota Prius and Chevrolet Cobalt, 3-vehicle crash with human-driven Ford Crown Victoria contacting the rear of a Chevrolet Malibu and pushing the Chevrolet Malibu into the right front of an angled Saturn wagon, and human-driven broadside impacts between a Ford Crown Victoria and a Toyota Prius and a Subaru WRX. Testing was conducted at the Las Vegas Motor Speedway, Nevada.

Results presented at ARC-CSI Conference, June 2-5, 2014, Las Vegas, NV

May 2014 Performed and participated in vehicle maneuver testing on a Kia Soul to measure various vehicle parameters, including steering wheel angle, brake pedal status, vehicle speed, RPMs, and seat belt status. Approximately 30 tests were conducted over two days in Anaheim, California.

July 2013 Performed and participated in instrumented Hybrid III dummy straight leg vertical drop tests at various heights to analyze loads in the lower extremities and spine in Signal Hill, CA.

May 2013 ARC-CSI 2013 - Performed and participated in remote-driven Saturn SL2, Chevrolet Cavalier, and Chevrolet Impala rear-ending and broadsiding a Neoplan city bus containing an instrumented driver, passengers, and a Hybrid III dummy; human driver and remote-driven Toyota Yaris(s) in front-to-barrier impacts; angled head-on collisions between human-driven Ford Crown Victoria and Chevrolet Cavaliers; and a head-on collision between remote-driven Pontiac Grand Ams. All tests performed at the Las Vegas Motor Speedway, Nevada.

Results presented at ARC-CSI Conference, May 13-16, 2013, Las Vegas, NV

May 13, 2013 Performed and participated in front and rear to barrier impacts using a Toyota Yaris with an instrumented human driver and a Hybrid III dummy passenger; as well as hard braking of a Neoplan city bus and an angled broadside to a Honda Civic with an instrumented human driver, passengers and a Hybrid III dummy at the Las Vegas Motor Speedway, Nevada.

May 13, 2013 Performed and participated in instrumented Hybrid III dummy head impacts with an industrial light fixture, as well as an un-instrumented human volunteer light fixture-to-head impact test in Signal Hill, California.

June 4, 2012 ARC-CSI 2012 - Performed and participated in crash tests with instrumented human volunteers and anthropomorphic dummies, including a remote-driven Pontiac Grand Prix striking a Ford E350 Ambulance in an angled broadside, a Chrysler Town & Country with a remote tire deflation striking a Ford Aspire in an offset rear-end and then broadsiding a Toyota Corolla, a Ford Crown Victoria striking a Saturn SL2 in a high speed high angle broadside, a remote-driven Kia Rio striking a Toyota Yaris in an angled head-on, a remote-driven Jeep Grand Cherokee striking a Fiat Bertone in a high speed offset head-on with override and a rollover, a Ford Crown Victoria side-swiping a Kia Sephia and then broadsiding a Ford Escort, and a remote-driven VW Jetta broadsiding a Chrysler Town & Country at the Las Vegas Motor Speedway, Nevada.

Results presented at ARC-CSI Conference, June 4-7, 2012, Las Vegas, NV
Results presented for instruction at Collision Safety Institute, Inc. CDR Data Analyst Course, October 1-5, 2012, Glendale, AZ

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June 3, 2012 Performed and Participated in rear-end crash tests between a Jeep Grand Cherokee with active head restraints and a Chrysler Town & Country utilizing instrumented human volunteers and anthropomorphic dummies and a remote tire deflator at the Las Vegas Motor Speedway, Nevada.

Results presented at ARC-CSI Conference, June 6, 2012, Las Vegas, NV
Results presented at CDR User's Summit, January 21-23, 2013, Houston, TX

June 2012 Performed and Participated in a broadside crash test between a Ford Contour and a Ford Crown Victoria utilizing instrumented anthropomorphic dummies at the Las Vegas Motor Speedway, Nevada.

Nov. 14, 2011 Performed and participated in instrumented offset rear-end, over-ride rear-end, angled rear-end, and side-swipe collisions between a Chrysler LeBaron, Kia Sephia, and Ford F-150 in Las Vegas, Nevada.

August 2011 Performed raft on water slide testing to evaluate the potential for coccyx impact with the surface of the slide. Weighted surrogates, human surrogates and skeletal models were utilized.

5/22-23/2011 ARC-CSI 2011 - Performed and participated in a series of instrumented automobile to automobile collision tests utilizing human volunteers. Testing included a series of rear end collisions involving a 2008 Buick Regal into a 2008 Buick LaCrosse, frontal collision between a 2006 Chrysler 300 and a 2002 Pontiac Grand Prix; impact between the front of a 2006 Ford Crown Victoria and the left side of a 2004 Hyundai Sonata; chain reaction rear end collision involving a 2006 Toyota Sienna, 1989 Ford Probe, and 1997 Dodge Neon; collision between the front of a 2008 Buick LaCrosse and the left side of a 1997 Ford Aspire; offset collision between the let front of a 2006 Chrysler 300 and a 2006 Ford Escape; chain reaction collision between a 2009 Buick Regal, 1999 Chevrolet Cavalier, and 1998 Chevrolet Camaro.

Results presented at ARC-CSI Conference, May 23-26, 2011, Las Vegas, NV
Results published in Collision: The International Compendium for Crash Research, Volume 6, Issue 2, Fall 2011
Results presented for instruction at Collision Safety Institute, Inc. CDR Data Analyst Course, October 1-5, 2012, Glendale, AZ

May 23, 2011 Performed and Participated in vehicle-to-vehicle low-speed crash tests, with an instrumented human volunteer driver in a Toyota Celica convertible during a frontal and broadside-to-right door impacts with the trailer hitch of a backing Chevrolet Suburban at the Las Vegas Motor Speedway, NV.

Feb.17-18,2011 Performed and participated series of head impact tests with a Hybrid III 5th percentile female dummy. Implements included various balls, sporting equipment and household items. Acceleration, high speed film, and angular velocity data was collected for analysis.

Feb 8, 2011 Performed testing with a Hybrid III 5th percentile female dummy to evaluate the effects of a sink faucet falling from a shelf onto someone's head. The dummy head was instrumented, and the impact conditions of the faucet were varied. Kinematic and injury data was captured and processed.

Sept 28, 2010 National Crash Analysis Conference (NCAC) – Performed a high-speed rear end collision with an instrumented Hybrid III 50th percentile male dummy. Assisted with test set-up, ATD placement, sensor calibration and data collection.

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May 24, 2010 ARC-CSI 2010 – Performed and participated in 19 instrumented vehicles and some instrumented human impact tests. Tests included inline/chain reaction rear end impact of a 2002 Cadillac SLS into a stopped 2002 Pontiac Grand AM and a stopped 2000 Chevrolet/Geo Metro, two motorcycle and one scooter impact it the side of a 1998 Mercury Grand Marquis, 2002 Pontiac Grand AM into the rear of a semi-trailer, 2001 Monte Carlo into the side of a semi-trailer, a 1996 Saturn SL into the side of a semi-trailer, frontal impact of a 2002 Ford Crown Victoria into a 2000 Ford Crown Victoria, offset frontal impact of a 2001 Chevrolet Impala into a 1996 Chevrolet Cavalier, four lower speed rear-end impacts with a Chevrolet S10 pickup rear-ending a 2001 Chevrolet Impala and six impact where a 2001 Chevrolet S-10 pickup hits common debris such as a water heater, washing machine, mattress, latter, and a wheel (tire and rim).

June 1, 2009 ARC-CSI 2009 – Performed and participated in 11 instrumented vehicles and some instrumented volunteer impact tests including a 2009 Dodge Journey into a 1991 Chevrolet Cavalier, a 2002 Chevrolet Malibu into a semi-trailer, 2002 Ford Crown Victoria Police Interceptor into a semi-trailer, a 2003 Ford Taurus into a semi-trailer, a 2009 Dodge Ram 1500 pickup into a 1991 Ford Ranger pickup, 2006 Ford Crown Victoria into a 1997 Ford Contour, four attempted rollovers of a 2009 Jeep Grand Cherokee, and a 2009 Jeep Grand Cherokee into a 2009 Dodge Journey.

June 2, 2008 ARC-CSI 2008 – Performed and participated in 12 instrumented vehicles and some instrumented volunteer impact tests. Tests included a 1989 Yamaha FZR600 motorcycle broad siding a 1989 Honda Civic CRX, two PIT maneuvers with a 2002 Ford Crown Victoria Police Interceptor and a 2000 Dodge Intrepid and 1991Ford Ranger, a pedestrian dummy impact by a 1998 Chevrolet Malibu, an angled frontal impact between a 2002 Ford Crown Victoria and a 1989 Honda Civic CRX, a 1989 Yamaha XJ700N motorcycle broad siding a 1984 Dodge van, a bus hitting a 1996 Kia Sephia, a 2000 Intrepid broad siding a 1984 Dodge Van, a Ford Ranger frontal and rear impact to a K-Rail type barrier, Dodge Intrepid sideswiping a K-Type rail, and a tire falling off of a 2000 Dodge Intrepid with instrumented human volunteer.

June 3-4, 2007 ARC-CSI 2007 – Performed and participated in 18 instrumented vehicles and some instrumented volunteer impact tests. Tests included eleven crashes with the front of a YEAR Chevrolet impacting the rear of a 1986 Jeep Cherokee at incrementally increasing impact speeds for bumper-to-bumper impacts and bumper-to-trailer hitch impacts at the same speeds, the front of a 1993 Jeep Grand Cherokee contacted the right front corner of a 1983 Toyota Tercel, the front of a 2000 Chevrolet Malibu broadsided a 1995 Ford Aspire, the front of a 2002 Ford Crown Victoria contact the front of a 1994 Chevrolet Corsica, The front of a 2000 Ford Crown Victoria contacted a trailer towed by a 1986 Jeep Cherokee. Additional testing included two tests where an instrumented human volunteer drove a 1991 Chevrolet Cavalier while the wheel dropped off the vehicle.

Jan 11, 2007 Performed and participated three instrumented vehicle rear-end impact tests examining the impact performance of a 1989-1995 Toyota pickup rear bumper.

Aug 19, 2006 Performed and participated in a series of fourteen instrumented vehicle crash tests. Tests included twelve front-to-rear (rear-end) impacts with an instrumented 1994 Lincoln Continental rear-ending a 1993 Chrysler LeBaron with either an instrumented human volunteer or an instrumented Hybrid III crash test dummy and two high-speed pedestrian impacts with the front of the 1994 Lincoln Continental impacting a crash test dummy as a pedestrian

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June 4-5, 2006 Performed and participated in a series of twenty-six instrumented vehicle crash tests. Tests included sixteen curb impact tests with a 1997 Chevrolet Astro van and a 1991 Geo Metro, a rollover of a 1991 Ford Explorer, two car to motorcycle test, the front of 2000 Chevrolet Malibu contacting the side of a 1991 Geo Metro, two tests with a 1975 Establishment fire engine impacting the front right corner of a 1997 Chrysler LeBaron and the front of a 1997 Chevrolet Astrovan, a three vehicle collision with 1973 Thomas school bus rear-ending a 1994 Hyundai Elantra and pushing the Hyundai forward into the rear of a 1972 Winnebago, a three vehicle collision with 1998 Ford Crown Victoria rear-ending a 1987 Subaru GL and pushing the Subaru forward into the side of a 1993 Chevrolet Caprice. Aug 27, 2005 Performed and participated in a series of twelve instrumented vehicle crash tests. Tests included nine front-to-rear (rear-end) impacts with an instrumented 1998 Monte Carlo rear-ending a 1992 Chrysler LeBaron with an instrumented human volunteer and three moderate speed instrumented frontal collisions between the 1992 Chrysler LeBaron, 1998 Monte Carlo and a 1992 Mazda 929 (broadsided).

June 6-7, 2005 Performed and participated in a series of nine instrumented vehicle crash tests. Tests included a front-to-rear (rear-end) impact with an instrumented 2001 Ford Crown Victoria (push bars) with an instrumented occupant traveling at approximately 50 mph rear-ending an instrumented 1997 Ford Crown Victoria traveling at approximately 40 mph, a front-to-rear (rear-end) impact with an instrumented 1997 Ford Crown Victoria (no push bars) with an instrumented occupant traveling at approximately 50 mph rear-ending an instrumented 2001 Ford Crown Victoria traveling at approximately 40 mph, two impacts with the front of an instrumented 2001 Chevrolet Cavalier impacting a crash test dummy as a pedestrian, the front of an instrumented 2001 Crown Victoria with an instrumented human volunteer impacting the front of a 1998 Hyundai Sonata, the front of an instrumented 1986 Mazda RX7 impacting an instrumented tractor trailer, the front of an 1997 Pontiac Grand Prix impacting the rear of the 1986 RX7 (at POR from prior), and the front of an 2001 Pontiac Grand AM impacting and instrumented 2001 Chevrolet Cavalier and shoving the Cavalier under the side of tractor trailer.

Aug 21, 2004 Performed and participated in a series of fourteen instrumented vehicle crash tests. Tests included eleven front-to-rear (rear-end) impacts with an instrumented 1992 Ford Crown Victoria rear-ending a 1993 Chrysler LeBaron with an instrumented human volunteer and instrumented Hybrid III crash test dummy and two high-speed pedestrian impacts with the front of the 1992 Ford Crown Victoria impacting a crash test dummy as a pedestrian.

July 14, 2004 Performed and participated in a series of four acceleration, deceleration and turning tests of a 2001 Thomas MTA bus.

June 21, 2004 Performed and participated in a series of seven instrumented vehicle crash tests. Tests included a high speed frontal impact of a 1996 Chevrolet Cavalier into a barrier, the front of an instrumented 1998 Pontiac Grand AM with an instrumented human volunteer into the front of 2000 Buick Century with a human volunteer, the front of an instrumented 2000 Buick Century with an instrumented human volunteer into the side of an instrumented Neon, two moderate speed frontal impacts with an instrumented 2000 Buick Century with an instrumented driver impacting a barrier, a high speed frontal impact with and instrumented 1998 Pontiac Grand AM impacting a barrier, and the front of an instrumented 1997 Ford Crown Victoria with an instrumented driver impacting the side of a Ford Tempo.

June 20, 2004 Performed and participated in six instrumented vehicle crash tests. Tests included a front-to-rear (rear-end) impacts with the front of an instrumented 1998 Pontiac Grand AM with an instrumented human volunteer driver impacting the rear of an instrumented 2000 Buick Century with an instrumented human volunteer and front of an instrumented 2000 Buick Century with an instrumented human volunteer driver impacting the rear of a instrumented 1998 Pontiac Grand AM with an instrumented human volunteer.

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April 20, 2004 Performed and participated in two instrumented seat pull tests and nine instrumented Hybrid III head form drop tests. Instrumented seat pull tests were conducted to evaluate the rearward force deflection characteristics of a 1993 Dodge Dakota pickup seat. Head form drop tests were conducted to evaluate the effects of an occupant hitting their head on the rear cab and rear glass of a 1994 Dodge Dakota pickup. An instrumented head form was dropped onto the rear body panel at various speeds.

April 6, 2004 Performed and participated in three instrumented Hybrid III head form drop tests to evaluate the effects of an occupant hitting their head on the rear interior body panel of a Chevrolet S10/GMC Sonoma after seat failure. An instrumented head form was dropped onto the rear body panel at various speeds.

Mar 29, 2004 Performed and participated in a series of four instrumented vehicle crash tests. Tests included four frontal impact tests to determine the low speed impact performance of the front bumper of a 1998 Chevrolet Suburban.

Feb 24, 2004 Performed and participated in a series of five instrumented vehicle crash tests. Tests included a front-to-rear (rear-end) impacts with the center front of an 1986 Honda Prelude rear-ending a trailer hitch on an instrumented 1993 Chevrolet Blazer with and instrumented human volunteer, a front-to-rear (rear-end) impacts with the left front of an 1986 Honda Prelude rear-ending the right approximately 40% of an instrumented 1993 Chevrolet Blazer with and instrumented human volunteer, and there tests with an instrumented 1993 Chevrolet Blazer with trailer hitch backing into the door of a 1986 Honda Prelude.

Aug 27, 2003 Performed and participated in a series of thirteen instrumented vehicle crash tests. Tests included eleven front-to-rear (rear-end) impacts with an instrumented 1994 Ford Crown Victoria rear-ending a 1987 Chrysler LeBaron with instrumented human volunteers and BioRID crash test dummy and two high-speed pedestrian impacts with the front of the 1994 Ford Crown Victoria impacting a crash test dummy as a pedestrian.

July 17, 2003 Performed and participated in three instrumented Hybrid III head form drop tests to evaluate bicycle helmet performance. An instrumented head form was dropped without a helmet on. The test was then repeated with a standard bicycle helmet on the head form.

June 8-9, 2003 Performed and participated in a series of seven instrumented vehicle crash tests. Tests included three low speed front-to-rear (rear-end) impacts with an instrumented 2000 Chevrolet Malibu rear-ending a 1994 Kia Sephia to produce near-deploy files in Ford RCM's and GM SDM's in the Chevrolet, a ramp vault of the instrumented Chevrolet with an instrumented human volunteer and Hybrid III crash test dummy with a subsequent high-speed broadside into the side of the Kia with airbag deployment in the Chevrolet, two ramp vaults of a instrumented 1995 Ford Crown Victoria with an instrumented human volunteer and Hybrid III crash test dummy, and a high-speed broadside collision of the Ford with an instrumented human volunteer and Hybrid III crash test dummy into the side a 1994 Ford Tempo with airbag deployment in the Ford Crown Victoria.

April 29, 2003 Observed two rollover tests and numerous motorcycle braking tests. Tests were conducted as part of the Special Problems in Traffic Crash Reconstruction, Institute of Police Technology and Management (IPTM) Conference.

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April 17, 2003 Performed and participated in four instrumented golf cart tests. Tests were conducted to quantify the vehicle acceleration associated with driving a golf cart along the normal golf cart path.

April 16, 2002 Performed and participated in a series of six tests to determine the motions and accelerations associated with an amusement park ride. Testing was conducted with and instrumented vehicle and human volunteer.

Feb 12, 2003 Performed and participated in a series of five tests to determine the motions and accelerations associated with an amusement park ride. Testing was conducted with and instrumented vehicle and human volunteer.

Dec 17, 2002 Performed 8 instrumented tests in which the force of impact from retail sign dropped various distances was quantified.

Oct 9, 2002 Performed and participated in a series of 6 instrumented vehicle crash tests in which a 2002 Buick Century Custom was backed into the front of 2002 Chevrolet Cavalier. An uninstrumented human volunteer with pre-existing 7 mm disc bulges at C5-6 and C6-7 drove the Buick.

Oct 8, 2002 Performed and participated in a high speed instrumented human volunteer frontal-broadside impact to examine air-bag performance. Tests were conducted and aired on the Tonight Show.

Oct 3, 2002 Performed and participated in a series of 8 instrumented vehicle impacts. Testing included 4 bus into vehicle impacts with instrumented vehicle and human volunteers and 3 semi-trailer into vehicle and one vehicle into semi-trailer. Crashes were part of the CAARS conference.

August, 2002 Performed and participated in a series of 5 crash tests. Two of the crash tests use an instrumented Hybrid III crash test dummy alongside an instrumented human volunteer. Three lower speed crashes were conducted to examine data that may be collected by the standard SDM/CDR compared to actual recorded data. Vehicles included a 1996 Chevrolet Lumina, 1994 Ford Taurus, 1980 Mazda GLC, and 1989 Hyundai Excel. Crashes were part of the ARC-CSI Conference.

Aug 10, 2002 Performed and participated in a series of 14 instrumented vehicle-to-vehicle impact tests with human volunteers and a RID2 crash test dummy. Impact configurations included 13 rear-end impacts and one lateral impact. Vehicles used included a 1994 Ford Crown Victoria, 1989 Chrysler LeBaron, and a 1989 Toyota Corolla.

6/29-30/2002 Performed and participated in a series of 10 instrumented front-to-rear vehicle-to-vehicle crash tests with human volunteers. Tests were configured to compare bumper-to-bumper vehicle and occupant response to underride response. Test vehicles included 1984 Dodge Aires, 1987 Ford Escort, 1987 Honda Accord, 1989 Acura Integra, and a 1996 Acura Integra.

June 27, 2002 Performed and participated in a series of 8 instrumented tests in which bumper components from the rear of a 1989-1992 Chevrolet S-10 pickup, 1985 Volvo and Jaguar XJS were tested.

Jan 25, 2002 Performed and participated in a series of 5 instrumented tests in which an instrumented Hybrid III crash test dummy was exposed to various everyday activities. The dummy was instrumented to record head acceleration, neck force and neck moments.

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Jan 24, 2002 Performed and participated in a series of 9 instrumented tests in which various ceiling materials where dropped on the head of an instrumented Hybrid III crash test dummy. The dummy was instrumented to record head acceleration, neck force and neck moments.

Nov 7, 2001 Performed and participated in a series of 3 instrumented side impact vehicle-to-vehicle crash tests with human volunteers. An instrumented 1991 Ford Explorer impacted side A-pillar area of a 1996 Acura Integra at impact angles from 46 to 82 degrees. An instrumented male volunteer was seated in the driver's seat for two of the tests.

Oct 31, 2001 Performed and participated in a series of 5 impact tests in which an instrumented Hybrid III crash test dummy was dropped from a standing height onto various deck surfaces. The dummy was instrumented to record pelvis acceleration, neck force and neck moments.

Aug 25, 2001 Performed and participated in a series of 13 instrumented vehicle-to-vehicle impact tests with human volunteers. Impact configurations included three impacts with the front of a 2000 Chevrolet Impala rear-ending a 1994 Ford Taurus, three impacts with the Taurus rear-ending the Impala, three impacts with the Impala rear-ending a 1996 Chevrolet Cavalier, three impacts with the Cavalier rear-ending the Impala, one higher speed impact with the left rear corner of the Taurus backing into the right side of the Cavalier at approximately 50 degrees, and one high-speed frontal impact with the front of the Impala impacting the front of the Taurus. Human volunteers were present in both vehicles and the airbags deployed in both vehicles.

April 5, 2001 Performed and participated in a series of two instrumented high-speed frontal airbag deployment tests. Impact configuration included the front of a 1991 Isuzu Stylus impacting the front of a similar 1991 Isuzu Stylus at 28 mph. The bullet Isuzu had an instrumented human volunteer driver exposed to an airbag deployment. The target vehicle had an unrestrained Hybrid II crash test dummy (no airbag). An additional test was performed with a 1994 Mercury Cougar traveling at 43 mph broad-siding a stationary 1990 Ford Festiva. The bullet Mercury had an instrumented human volunteer driver exposed to an airbag deployment. A non-seat belted, rearward facing child safety seat with a child CPR dummy in the right front seat was exposed to the passenger side airbag deployment.

Jan 23, 2001 Performed a series of 17 kicks to the side of an instrumented Hybrid III crash test dummy to quantify the head injury potential from a kick to the head of a prone individual. Various shoes and kick configurations were utilized.

9/9-10/ 2000 Performed and participated in a series of 25 instrumented side impact vehicle-to-vehicle crash tests with human volunteers. An instrumented FMVSS 301 moving barrier impacted the front, middle and rear of the right and left side of 1989 Ford Escort. Instrumented male and female volunteers were seated in the passenger and driver seat for each test.

Sept 7, 2000 Performed a series of three instrumented Hybrid III head form drop tests. The instrumented head form was dropped on foam, and two times on the passenger door panel of a Nissan 300 ZX 2+2. Testing was conducted at Biomechanical Research & Testing, LLC.

Aug 28, 2000 Performed a series of two instrumented Hybrid III head form drop tests. The instrumented head form was dropped on to foam and on the side glass from a 1996 Ford Crown Victoria. Testing was conducted at Biomechanical Research & Testing, LLC, with Burkhard Methods and Analysis Corporation.

Aug 11, 2000 Performed and participated in a series of 19 instrumented vehicle-to-vehicle impact tests with human volunteers. Impact configurations included six impacts with the front of a 1992 Ford Taurus rear-ending a 1992 Chrysler LeBaron Convertible, six impacts with the LeBaron rear-ending the Taurus, three impacts with the LeBaron rear-ending a 1994

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Hyundai Excel, three impacts with the Hyundai rear-ending the LeBaron, and one high-speed frontal impact with two moving vehicles in a head on collision. Human volunteers were present in both vehicles and the airbags deployed in both vehicles.

July 6-7, 2000 Performed and participated in a series of 19 instrumented FMVSS 301 moving barrier into a 1992 and 1995 Ford F150 pickup. Both the target pickup and moving barrier were instrumented. All impact configurations included impact severities to cause only cosmetic damage, damage onset, and minor damage. Impacts were conducted to the front, rear, left front corner, right front corner, offset rear, right and left bedside panel, right and left door, and right and left fender. Tests were conducted at Biomechanical Research & Testing, LLC.

6-8/15/2000 Performed and participated in over 228 instrumented pendulum (Title 49 CFR Part 581 bumper impact testing pendulum with modified impacting plate) test sled impact tests. Over 100 of the tests utilized a BioRID-P3 anthropomorphic test device (i.e. "crash test dummy") instrumented with head, T1, T8, L1, and pelvis accelerometers; neck load cell; and head mounted angular rate sensor. Three separate 2000 model GM seats were utilized for testing with a total of 32 separate foam configurations. Differing bumper foams were used during testing to evaluate the effects of impact duration and pulse shape on occupant kinematics and injury potential. Over 100 occupant response variables were utilized for statistical analysis.

May 25, 2000 Performed and participated in a series of four instrumented vehicle-to-vehicle impact tests with human volunteers. Impact configuration included two tests with a 1989 Acura Legend rear-ending a 1996 Volvo 850, a broadside impact with the front the Acura contacting the left side of the Volvo, and a high speed rear-end collision with an instrumented human volunteer driving a 1999 Cadillac Deville into the rear of a 1986 Oldsmobile 98 Regency Brougham. The airbag on the Cadillac deployed and the SDM data from the Cadillac was downloaded.

May 11, 2000 Performed and participated in a series of seven instrumented vehicle-to-vehicle impact tests with human volunteers. Impact configurations included three impacts with a 1987 Ford Escort rear-ending a 1986 Buick Skylark, two angled broadside impacts with the left front and right front, respectively of the Buick contacting the side of a 1986 Ford Aerostar minivan, an angled rear-end impact with the right front of the Aerostar rear-ending the Buick, and a sideswipe impact with the right side of the Buick contacting the left side of the Aerostar. Tests were conducted at the Texas A&M University, Texas Engineering Extension Service campus in Houston, Texas.

April 24, 2000 Performed and participated in two tests to determine the force and change in speed required to deform the control arm from a 1980-1992 Volkswagen Vanagon. Tests were conducted at Biomechanical Research & Testing, LLC, with Collision Dynamics Analysis.

April 8, 2000 Performed and participated in a series of ten instrumented vehicle-to-vehicle impact tests with human volunteers. Impact configurations included two impacts with the front of a 1984 Volkswagen Rabbit rear-ending a 1990 Mercury Sable, and angled rear-end impact with the corner of 1986 Chevrolet Astro Van rear-ended the Sable, a angled broadside impact with the other corner of the 1986 Chevrolet Astro Van contacting the left rear side of the Sable, a sideswipe impact with the right side of the Rabbit sliding along the left side of the Astro Van, two offset rear-end collisions with the Rabbit rear-ending the Astro Van, a broadside impact with the rear of the rabbit backing into the side of the Astro Van, and two high-speed chain reaction rear-end collisions in which an instrumented human volunteer driving the Sable rear-ended the stationary Rabbit pushing it forward into the Astro Van. The airbag in the Sable deployed in the second impact test.

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Mar 27, 2000 Performed and participated in two instrumented frontal crash tests evaluating the performance of piston energy absorbers from a 1992-1997 Cadillac Seville. Tests were conducted at Biomechanical Research & Testing, LLC in conjunction with Collision Dynamics Analysis.

March 2000 Performed a high-speed human volunteer frontal collision into a pedestrian crash test dummy and a high-speed instrument human volunteer frontal-broadside collision test with airbag deployment. Tests were conducted at the Law Enforcement Training Facilities in Charlotte, North Carolina

Feb 28, 2000 Performed a high-speed instrument human volunteer frontal collision test with airbag deployment. The front of a 1992 Volvo 965 wagon rear-ended a 1979 Fiat.

Aug 26, 1999 Performed and participated in a series of eight instrumented vehicle-to-vehicle impact tests with human volunteers. Impact configurations included three impacts with the front of 1983 Oldsmobile Regency 98 contacting the rear of a 1975 Buick Skylark, an angled offset rear-end collision with the left front corner of the Oldsmobile contacting the rear bumper of the Buick, a sideswipe/lane-change impact with the left side of a 1976 AMC Gremlin contacting the right side of the Buick, a chain reaction rear-end impact with the front the Buick rear-ending the Gremlin pushing it forward into the rear of the Oldsmobile, one impact with the left front of the Buick contacting the side the Gremlin. Tests were conducted at the Washington Criminal Justice Training Center in Seattle, Washington.

Aug 14, 1999 Performed and participated in a one instrumented offset angled rear-end impact test. The right front of corner of a 1997 Ford Ranger pickup contacted the right rear corner of a 1995 Chevrolet Astro Passenger van. Tests were conducted with Jerry Eubanks.

Aug 14, 1999 Performed and participated in series of fifteen instrumented vehicle-to-vehicle impact tests with human volunteers. Impact configurations included three impacts with the front of a 1991 Honda Civic rear-ending a 1991 Lincoln Continental, three impacts with the front of the 1991 Lincoln Continental rear-ending the 1991 Honda Civic, three impacts with the front of a 1989 Ford Tempo rear-ending the Honda, one impact with the 1989 Ford Tempo contacting the right rear side of the Honda in an eccentric broad-side impact, one impact with the left rear corner of the Honda backing into the left rear side of the Ford, a sideswipe/lane-change impact with the left side of the Lincoln contacting the right side of the Tempo, one impact with the front of the Lincoln contacting the rear of the stopped Ford at 36.8 mph. Rusty Haight and Jerry Eubanks.

June 30, 1999 Performed and participated in a series of fifteen instrumented human volunteer tests examining effects of evasive vehicle swerving, accelerations (forces) of everyday activities including being bumped into from a walking individual both rear-to-back and side-to-side contacts, being slapped, and hitting one's own head. Tests were conducted at Biomechanical Research & Testing, LLC.

May 6, 1999 Performed and participated in a series of six tests to determine the motions and accelerations associated with an amusement-park ride.

April 5, 1999 Performed and participated in a series (April 5, 1999, April 9, 12 and 28, 1999, and May 27, 1999) of in excess of 110 instrumented tests to determine the motions and accelerations associated with multi-directional amusement-park ride. Instrumented human subject testing was conducted with a small male child, a 50th percentile female, and a 50th percentile male.

Mar 17, 1999 Participated in an instrumented vehicle-to-barrier impact with an instrumented Ford van impacting a trailer hitch receptacle mounted to a rigid barrier. Test was part of a four-

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impact series to assess the bumper performance in contacts with a trailer hitch receptacle. Tests were conducted at Biomechanical Research & Testing, LLC.

Feb.25-26,1999 Performed and participated in 13 vehicle-to-vehicle impact tests with instrumented human volunteers. Impact configuration included two rear-end impacts with the front of a 1989 Nissan 240SX rear-ending a 1987 Honda Prelude, one underride impact with the front of the Nissan underriding the rear of the Honda, two lateral impacts with the front of the Nissan contacting the side of the Honda, three rear-end impacts with a 1996 Chevrolet C1500 pickup rear-ending a 1992 Ford Aerostar van, two rear-end impacts with the Ford Aerostar van rear-ending the Chevrolet pickup, two rear-end impacts with the front of the Nissan rear-ending a 1992 Ford Taurus and one high-speed frontal impact with the front of the Ford Taurus contacting the rear of the Ford Aerostar, deploying the Ford's airbag. Tests were conducted in Houston, Texas with Engineering and Fire Investigations, Inc.

Jan 10, 1999 Performed and participated in eight vehicle-to-vehicle rear-end impact tests with instrumented human volunteers. Three different volunteers were tested representing an approximately 50th percentile female, a 50th percentile male and a 95th percentile male. Each occupant was exposed to two different vehicle velocity changes. Two of the tests were conducted at higher impact severities to evaluate contemporary seat safety designs. Tests were conducted to evaluate the influential variables affecting occupant injury parameters in rear-end collisions. Tests were conducted at Biomechanical Research & Testing, LLC.

Jan 10, 1999 Performed and participated in five vehicle-to-vehicle rear-end impact tests. An instrumented female human volunteer representing an approximately 50th percentile female was exposed to vehicle Delta V's of 1, 2, 3, 4 and 5 mph. Tests were conducted to assess the relationship between vehicle velocity change and occupant kinematic parameters and injury potential. Tests at BRT, LLC.

Jan 9, 1999 Performed and participated in instrumented seat component testing to evaluate different vehicle seat dynamic and static properties. Static tests were performed in a manner consistent with Federal Motor Vehicle Safety Standard (FMVSS) 202. Dynamic tests were conducted to simulate a 50th percentile male contacting the seat at 2.5 and 5 mph. Tests were conducted at Karco Engineering.

11/30/1998 – 12/4/1998 Performed and participated in eight vehicle-to-vehicle impact tests with instrumented human volunteers. Impact configurations included three impacts with the front of a 1984 Nissan Sentra rear-ending a 1987 Ford Escort, one angled rear-end impact with the Escort rear-ended by a 1985 Nissan pickup, one impact with the Nissan pickup broad-siding the Escort, one impact with the Nissan sideswiping the Escort, one impact with the Nissan broad-siding the Nissan and one impact with the pickup broad-siding the other side of the Nissan at 33 mph. Tests were conducted with the Massachusetts State Police at the Massachusetts State Police Academy in New Braintree, MA.

Nov 16, 1998 Performed and participated in elevator drop tests with an instrumented human volunteer. Tests were conducted to determine the effects of various elevator malfunctions on an instrumented occupant. Additional everyday activity testing was conducted to quantitatively compare with the elevator tests.

Oct 27, 1998 Performed and participated in train deceleration tests with an instrumented human volunteer. Tests were conducted to determine the magnitude and effects of train deceleration on an occupant suspended from the side ladder of a freight car.

Oct 20, 1998 Performed and participated in instrumented go-kart rollover tests. The go-kart was instrumented with triaxial accelerometers and a triaxial array of pitch sensors to measure

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vehicle response. An instrumented Hybrid III anthropomorphic test dummy seated in the occupant compartment was instrumented with a triaxial accelerometer array at the head center of gravity, chest center of gravity and pelvis. Chest deflection was measured via a potentiometer. Neck forces and moments were measured in all three orthogonal directions. Femur loads were recorded. Tests at Karco Engineering.

Oct 13, 1998 Performed and participated in instrumented seat component testing to evaluate different vehicle seat dynamic and static properties. Static tests were performed in a manner consistent with FMVSS 202. Dynamic tests were conducted to simulate a 50th percentile male contacting the seat at 2.5 and 5 mph.

Sept 4-6, 1998 Performed and participated in 34 vehicle-to-vehicle rear-end impact tests with instrumented human volunteers. Three different volunteers were tested representing an approximately 50th percentile female, 50th percentile male and 95th percentile male. Each occupant was exposed to two different Delta V's in 5 different seat configurations. Two of the tests were conducted at higher impact severities to evaluate contemporary seat safety designs. Tests were conducted to evaluate the influential variables affecting occupant injury parameters in rear-end collisions. Tests conducted at Biomechanical Research & Testing, LLC.

Aug 14, 1998 Performed and participated in two vehicle-to-vehicle rear-end impact tests with an instrumented human volunteer. The first test involved the front of a 1991 Ford Explorer contacting the left rear corner of a 1987 Plymouth Voyager minivan. The second impact involved the Ford contacting the right rear corner of the minivan. Tests conducted at C.D.A. and at BRT, LLC.

July 25, 1998 Performed and participated in ten vehicle-to-vehicle rear-end impact tests with an instrumented human volunteer. Tests were conducted at target vehicle changes of speed between approximately 0.1 and 5 mph. All tests were conducted with the same female volunteer. Varying target vehicle velocity changes where utilized to examine the relationship between impact severity and the forces and resultant occupant motions. Tests were conducted at Biomechanical Research & Testing, LLC.

7/14-16/1998 Performed and participated in 22 vehicle-to-vehicle impact tests with instrumented human volunteers. Impact configurations included five impacts composed of sideswipes, broadsides and lane change-type impacts with a 1989 Volvo coming into contact with a 1992 Ford Taurus, one impact with a 1985 Nissan 200 SX broad-siding a 1987 Oldsmobile Regency, one impact with Oldsmobile contacting the left rear side of the Nissan in an offset broadside impact, four impacts with a 1988 GMC Suburban backing into the side of a 1992 Mercury Sable GS, two impacts with the Sable's right front contacting the left front side of a 1986 Chevrolet Caprice, three impacts with the Ford Taurus rear-ending a 1990 Acura Integra at various speeds and with various Acura braking conditions, one impact with a 1990 Honda Civic rear-ending and underriding the rear of the GMC Suburban, one impact with the GMC Suburban rear-ending and overriding the Honda Civic's rear bumper, one impact with the Suburban sideswiping the Civic, two offset angled rear-end impacts with a 1988 Chevrolet Camaro rear-ending a 1984 Ford Ranger pickup truck and one impact with the Ford Ranger pickup truck sideswiping the Camaro. Tests were conducted for the IAARS conference Boston, MA.

June 26, 1998 Performed and participated in a broadside impact in which the front of a 1991 Ford Explorer contacted the right rear bed section of a 1985 Chevrolet pickup truck (component test). Test was conducted at Collision Dynamics Analysis and Biomechanical Research & Testing, LLC.

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April 23, 1998 Performed and participated in seven vehicle-to-vehicle impact tests with instrumented human volunteers. Impact configurations included two impacts with a Buick Regal rear-ending a Ford Tempo, the Buick rear-ending the Ford with the Buick at a 35 to 40-degree angle, one rear-end impact with the Tempo underriding the Buick's rear bumper, the Tempo broad-siding the Buick and one override impact of a large dump truck into the rear of the Buick. An additional ten tests were performed with the Tempo perpendicularly impacting a curb at speeds between 2.2 and 23.5 mph. Human volunteer data were collected on the three fastest curb impacts. Tests were conducted at the TEEX facility in Mesquite, Texas.

Dec 13, 1997 Performed and participated in two vehicle-to-barrier impact tests with human volunteers and an instrumented Mazda RX7. Impact configurations involved an impact to the right rear corner at approximately 15 degrees from perpendicular and into the left rear corner at approximately 15 degrees from perpendicular. An instrumented male volunteer driver and an uninstrumented male volunteer were present in the first test. Tests were conducted at Biomechanical Research & Testing, LLC with Thomas Fugger of Accident Research and Biomechanics.

Dec 12, 1997 Performed and participated in six vehicle-to-barrier impact tests with an instrumented 1997 Jaguar XK8 and an instrumented human volunteer. Impact configurations included three impacts with the vehicle backed into the barrier and three with the vehicle driven forward into the barrier. An instrumented male volunteer was present in all tests. Tests were conducted at Biomechanical Research & Testing, LLC with Clark and Nelson, Inc.

Dec 3, 1997 Performed and participated in ten vehicle-to-vehicle impact tests with instrumented human volunteer. Impact configurations included four impacts with a Oldsmobile rear-ending a Ford Mustang, two impacts with the corner of a Toyota Celica impacting the front fender and rear quarter panel of an Oldsmobile, one impact with the front of a Toyota Corolla impacting the edge of an open driver's door of a Toyota Celica, one offset broadside impact with the front of a Ford Mustang contacting the right front tire area of a Toyota Corolla, a Ford Mustang sideswiping a Toyota Corolla and one high speed frontal impact with the front of the Ford Mustang contacting the front of the Oldsmobile. Both airbags deployed in the Ford Mustang during the high-speed frontal.

Oct 2, 1997 Performed and participated in twelve vehicle-to-vehicle impact tests with instrumented human volunteers. Impact configurations included five impacts with a Chevrolet Chevette rear-ending a Nissan Maxima, four impacts with the Nissan Maxima rear-ending the Chevrolet Chevette, two impacts with an Oldsmobile Achieva rear-ending a Ford Taurus and one impact with a Ford Taurus rear-ending the Chevrolet Chevette. Two of the impacts involved chain-reaction rear-end impacts. Tests were conducted at the NJAAR/NAPARS/NATARI/MATAI Joint Conference in Atlantic City, New Jersey with Rusty Haight and Jerry Eubanks.

Sept 11, 1997 Performed and participated in eight vehicle-to-vehicle impact tests with an instrumented human volunteer. Impact configurations included four rear-end impacts with a Ford Crown Victoria rear-ending a Ford Mustang, two rear-end impacts with the Ford Mustang rear-ending the Ford Crown Victoria, one offset lateral impact with the front of the Mustang contacting the front of the Crown Victoria and one sideswipe impact. An instrumented male volunteer was used in all tests. Tests were conducted at the South Carolina State Highway Patrol facilities in conjunction with the South Carolina Major Accident Investigation Team (MAIT).

Aug 19, 1997 Performed and participated in twenty-two vehicle-to-vehicle front-to-rear impact tests with a Dodge Shadow as the target vehicle and a Pontiac Bonneville as the bullet vehicle. An instrumented male volunteer was used in all tests. Test conditions evaluated the effects

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of varying degrees of occupant braking and bracing. Tests were conducted at Biomechanics Analysis in Tempe, Arizona.

Aug 12, 1997 Performed and participated in two instrumented vehicle-to-vehicle impacts. One rear-end impact was performed with a Plymouth Horizon rear-ending a similarly weighed vehicle at approximately 30 mph. The other impact involved a Chevrolet Suburban rear-ending a Plymouth Horizon at approximately 30 mph. Tests were conducted with Rusty Haight and Jerry Eubanks. Film footage aired on the television program 20/20 on September 11, 1997.

June 1, 1997 Performed and participated in a rear-end-to-barrier impact with an instrumented volunteer driver at an 8.0 mph closing speed. The instrumented driver was positioned with his head rotated 90 degrees to his right and his right arm was positioned across the bench-type seat back. The vehicle impacted the barrier at an angle of approximately 12.5 degrees from perpendicular. The test was conducted by Collision Dynamics Analysis and B.R.T.

April 25, 1997 Performed and participated in fourteen vehicle-to-vehicle impact tests with instrumented human volunteers. Impact configurations included rear and frontal impacts into poles, override impacts, aligned rear-end impacts and sideswipe impacts. Vehicles included a Ford F350 pickup, a Pontiac T1000, a Toyota Corolla, a Pontiac LeMans and a Ford Aerostar minivan. Tests were conducted at Billy Cox and Associates in Houston, Texas.

April 24, 1997 Performed and participated in seven vehicle-to-vehicle impacts with instrumented human volunteers. Impact configurations included rear-end impacts with various degrees of occupant braking and awareness, offset rear-end collisions, three-vehicle chain-reaction rear-end collisions, one oblique side impact and underride collisions.

April 15, 17, & 18, 1997 Performed and participated in a series of tests to determine the motions and accelerations associated with an amusement park ride.

3/20-28/1997 Performed and participated in twenty-seven instrumented vehicle impacts. A total of nine different vehicles were used including a Kia Sephia, a Bluebird Wanderlodge, a Ford Explorer, a Kenworth tractor with a Great Dane trailer, an Oldsmobile Cutlass Supreme, a Ford LTD, an Oldsmobile Cutlass Calais, a Ford LTD Landau and a Chevrolet Caprice. Eighteen of the impacts were rear-end type impacts. Underride collisions were performed to the side and rear of the Great Dane trailer. Frontal impacts to Jersey barriers were performed. Broadside collisions were also performed with instrumented vehicles and volunteers. All tests were performed at the TAARS – SOAR – WATAI – Crash 97 Combined Conference in College Station, Texas.

Dec 8, 1996 Performed and participated in twelve vehicle-to-vehicle impacts with an instrumented human volunteer. Impact configurations included aligned rear-end impacts, offset left and offset right rear-end impacts, a sideswipe, a broadside, a sideswipe of an open door, angled rear-end impacts and underride impacts. Vehicles used included a Pontiac Grand Am and an Oldsmobile Cutlass.

Oct 3, 1996 Performed and participated in eight vehicle-to-vehicle impacts with instrumented human volunteers. In all tests, an instrumented 1989 Hyundai Excel was contacted by a 1988 Ford Festiva. Impact configurations included five aligned front-to-rear tests, one angled rear-end impact, one sideswipe and one broadside impact.

July 14, 1996 Performed and participated in fifteen vehicle-to-vehicle front-to-rear impact tests with a Dodge Shadow as the target vehicle and a Chevrolet Nova as the bullet vehicle. An instrumented female volunteer was used in all fifteen tests. Tests were conducted at Biomechanics Analysis in Tempe, Arizona.

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7/12-13/1996 Observed nineteen instrumented vehicle-to-vehicle impacts with various types of vehicles with changes in velocity between .48 and 9.2 mph. Impact configurations included rear impacts to pickup trucks, aligned rear-end impacts, high-angle sideswipe, sideswipe and a three-vehicle chain-reaction impact. Vehicles included standard passenger vehicles and pickup trucks.

July 9, 1996 Performed and participated in three vehicle-to-barrier impact tests with an instrumented male human volunteer in a 1990 Chevrolet Corsica. The Chevrolet Corsica was backed into a barrier at three different impact speeds. Tests were conducted at Biomechanical Research & Testing with John Perry, Ph.D.

6/28-29/1996 Performed and participated in a series of tests with instrumented human volunteers to determine the motions and accelerations during horseback riding and riding in a motor boat.

June 15, 1996 Performed and participated in a series of tests with instrumented human volunteers to determine the motions and accelerations associated with activities of daily living.

June 14, 1996 Performed and participated in a series of five tests with instrumented human volunteers determining the motions and accelerations associated with braking a vehicle while driving backward, braking a vehicle while driving forward, going over a speed bump, plopping into vehicle seat and making a sharp turning maneuver.

June 14, 1996 Performed and participated in a series of five vehicle-to-vehicle front-to-rear impact tests with an instrumented human volunteer in a 1990 Honda Accord. Tests were conducted with target vehicle changes in velocity of 0.8, 1.1, 1.5, 1.8 and 3.3 mph. The volunteer was instrumented with accelerometers to measure occupant accelerations.

April 24, 1996 Performed and participated in a series of tests to determine the motions and accelerations associated with a new amusement park ride.

Feb 3-4, 1996 Performed and participated in a series of ten vehicle-to-vehicle front-to-rear impact tests with instrumented human volunteers in 1976 and 1977 Volvos. Volunteers were instrumented with EMG electrodes to measure muscle activity and with accelerometers to measure occupant accelerations.

Jan 19, 1996 Performed and participated in a series of tests to determine the motions and accelerations associated with numerous amusement park rides.

7/21-22/1995 Observed twenty-six rear-end impacts with various types of vehicles and impact speeds between 2.5 and 9.7 mph. Five of the tests included instrumented human volunteers exposed to Delta V's between 4.6 and 5.66 mph. A sideswipe and a lateral collision were also observed.

Oct 15, 1993 Performed and participated in a series of tests to determine the motions and accelerations associated with a boat-type amusement-park ride.

July 1, 1993 Performed and participated in a series of tests to determine the motions and accelerations experienced while riding a roller coaster.

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June 16, 1993 Performed a series of tests for the Scottsdale Police Department to determine the amount of force generated by various types of police batons utilizing three different stroke techniques.

May 13, 1993 Performed testing to determine the forces generated by the use of "less-than-lethal" projectiles for the Los Angeles Police Department.

March 4, 1993 Performed and participated in a series of tests to determine the motions and acceleration experienced while riding a roller coaster.

Jan 19, 1993 Performed a series of tests for the Los Angeles Police Department to determine the amount of force generated with a side-handle police baton using a power stroke technique. Also, conducted testing to determine the forces generated by the use of "less-than-lethal" projectiles.

January 1993 Performed a series of impact tests using an accelerometer-instrumented FMVSS head form. The head form was impacted against a passenger vehicle head restraint at various speeds.

January 1993 Performed a series of three bus-to-car impact tests. The car was instrumented with accelerometers.

September 15 & 17, 1992 Performed and participated in a series of tests to determine the motions and accelerations experienced while riding amusement park rides.

June 28, 1992 Performed and participated in a series of six vehicle-to-vehicle impacts tests with instrumented volunteers and vehicles at impact speeds of 6.6 to 10.6 mph. These tests were conducted with various impact configurations.

Mar 14, 1992 Performed a series of tests to determine the amount of force generated with various types of police batons using different stroke techniques.

January 1992 Performed and participated in six vehicle-to-vehicle front-to-rear impact tests using 1981-83 Ford Escorts at 5, 10 and 15 mph. Tests were conducted at Mobility Systems and Equipment Company, San Bernardino, California.

August 1991 Performed and participated in five vehicle-to-vehicle front-to-rear impact tests at 10 mph using 1981-83 Ford Escorts with instrumented human volunteers and anthropomorphic dummies. These tests were conducted at Mobility Systems and Equipment Company, San Bernardino, California.

July 1991 Observed a high-speed car-to-motorcycle front-to-rear staged crash test.

March 1991 Performed two pendulum-to-vehicle rear-impact tests at 5 and 10 mph using a 1988 Lincoln Town Car and an instrumented human volunteer. These tests were conducted at Mobility Systems and Equipment Company, San Bernardino, California.

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PROFFESIONAL AFFILIATIONS

American Society of Biomechanics

American Society of Mechanical Engineers

American Society for Testing and Materials - F24 Committee on Amusement Rides and Devices

Association for the Advancement of Automotive Medicine

Biomedical Engineering Society

Pi Tau Sigma, Mechanical Engineering Honor Society

Society of Automotive Engineers

Southwestern Association of Technical Accident Investigators

Sports Car Club of America (Licensed SSGT race car driver for 1989)

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PRESENTATIONS AND PUBLICATIONS

Kazmierczak, A., Umale, S., Visalli, A., Webb, E., Kashdan A., Randles, B., and Welcher, J., "Aggregation of Cervical Loads in Rear Impact Crash Tests and Comparison to Activities of Daily Living," SAE Technical Paper 2025-01-8708, 2025 (to be published 3/31/25)

Roescher, T., Randles, B., and Welcher, J., "Estimation of Seated Driver Eye Height based on Standing Height, Weight, Seatback Angle, and Seat Bottom Angle," SAE Technical Paper 2023-01-0838, 2023, doi:10.4271/2023-01-0838.

Welcher, J. "Sideswipe Collision Dynamics", Presented at the World Reconstruction Exposition (WREX), April 17-21, 2023. Invited speaker.

Kashdan, A., Umale, S., Kazmierczak, A., Kasselik, J., Randles, B., Furbish, C., and Welcher, J., "Aggregation of Lumbar Loads in Rear Impact Crash Tests," SAE Technical Paper 2023-01-0647, 2023, doi:10.4271/2023-01-0647.

Swinford, S., Jones, B., Brink, J., Furbish, C., Welcher, J., Anderson, R., "Study of the Measurement of Generation 2 Toyota Event Data Recorders in Low-Speed Side Impacts," SAE Technical Paper 2021-01-0904, 2021, doi:10.4271/2021-01-0904.

Brink, J., Swinford, S., Furbish, C., Jones, B., Welcher, J., Anderson, R., "Methods for Quantifying the Impact Severity of Low-Speed Side Impacts at Varying Angles," SAE Technical Paper 2020-01-0641, 2020, doi:10.4271/2020-01-0641.

Furbish, C., Welcher, J., Brink, J., Jones B., Swinford, S., Anderson, R., "Occupant Kinematics and Loading in Low-Speed Lateral Impacts," Society of Automotive Engineers (SAE) World Congress and Exhibition, 2019. SAE Paper No. 2019-01-1027.

Carpenter, N., Welcher, J., "Application of an exact energy theorem for surface sliding and crush energy in planar motor vehicle collisions," Society of Automotive Engineers (SAE) World Congress and Exhibition, 2019. SAE Paper No. 2019-01-0422.

Grimes, C., Roescher, T., Suway J., Welcher J., "Comparing the Accuracy of Image Based Scanning Techniques to Laser Scanners," Society of Automotive Engineers (SAE) World Congress and Exhibition, 2018, SAE Paper No. 2018-01-0525.

Suway, J., Welcher, J., "A Quantitative Method for Accurately Depicting still photographs or video of a night-time scene Utilizing Equivalent Contrast" Society of Automotive Engineers (SAE) World Congress and Exhibition, 2016, SAE Paper No. 2016-01-1463.

Suway, J., Welcher, J., "Retroreflective DOT-C2 Tape Performance in Relation to Observation and Entrance Angle – A Real World Study." Society of Automotive Engineers (SAE) World Congress and Exhibition, 2015, SAE Paper No. 2015-01-1432.

Suway, J., Welcher, J., "Quantifying Retroreflective DOT-C2 Tape Performance using a Retroreflectometer." Society of Automotive Engineers World Congress and Exhibition, 2015, SAE Paper No. 2015-01-1429.

Randles, B.C., Voss, D.V., Ikram, I.N., Furbish, C.J., Welcher, J.B., Szabo T.J., "Acceleration Testing and Modeling of Vehicle Kinematics Under Idle Conditions," *Society of Automotive Engineers*, SAE paper No. 2014-01-0484, in Occupant Protection: Accident Reconstruction, Society of Automotive Engineers, Inc., Warrendale, PA, April 2014.

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Popovich, J.M., Jr., Welcher, J.B., Hedman, T.P., Tawackoli, W., Anand, N., Chen, T.C., Kulig, K. (2013). Lumbar facet joint and intervertebral disc loading during simulated frontal plane pelvic obliquity. The Spine Journal. [published online ahead of print May 21, 2013].

Welcher, J., Popovich J., Hedman, T., Tawackoli W., "A New Sensor Array for Measuring Intra-Articular Pressure: Evaluation and Validation," Published and presented at 2010 Summary Bioengineering Conference, American Society of Mechanical Engineers. Naples, FL, Accepted for publication and presentation on June 18, 2010.

Randles, B., Jones, B., Welcher, J., Szabo, T., Elliott, D. and MacAdams, C. (2010). The accuracy of photogrammetry vs. hands-on measurement techniques used in accident reconstruction. Presented at the Society of Automotive Engineers International Congress and Exposition, Occupant Protection and Accident Reconstruction technical session, April 14, 2010, Society of Automotive Engineers Paper No. 2010-01-0065, Published in SP-2267 Accident Reconstruction 2010.

Popovich J., Welcher J., Cholewicki, J., Tawackoli W., Kulig K., "*The Effect of Follower Load on Lumbar Spine Facet Joint Forces and Intervertebral Disc Pressures,"* Published and presented at the Annual Meeting of the American Society of Biomechanics, Penn State University, University Park, PA, Poster presented August 28, 2009.

Welcher, J., Popovich J., Hedman, T., Tawackoli W., "*Development and Validation of a Versatile Intra-Articular Pressure Sensing Array,"* Published and presented at the Fourth North American Congress of Biomechanics (Joint meeting of the American Society of Biomechanics and Canadian Society of Biomechanics), Ann Arbor, Michigan, Presented August 6, 2008.

Singh J., Perry, J., Welcher, J., "*Single Point Crush Variation,"* Collision Magazine. Volume 3, Issue 1, 90-93, Spring 2008.

Popovich, J.M., Jr., Welcher, J.W., Kulig, K., Pelled, G., Gazit, D., and Tawackoli, W. (2007). *"The effect of loading rate on porcine lumbar spinal segments: An in-vitro biomechanical study,"* American Society of Biomechanics 2007 Annual Conference, Palo Alto, CA, August 22-25, 2007. (Abstract)

Welcher, J., Popovich, J., and Hedman, T. "*Development of a Novel Intra-Articular Pressure Sensing Array,"* 5th Published and presented at the 11th Annual Grodins Graduate Research Symposium, University of Southern California, Biomedical Engineering Department, April 11, 2007.

Welcher, J., *"Pedestrian Impact Biomechanics"* invited presentation and publication at ARC-CSI Crash Conference 2005.

Patel V., Welcher J., Bae H., Delamarter R., Pradhan B., Hedman T. "Floating and Fixed Center of Rotation Intervertebral Prostheses: Biomechanical Comparison" Proceedings of the Spine Arthroplasty Society Summit 4, Vienna Austria, May 2004.

Szabo T.J., Voss D.V., Welcher, J.B., *"Influence of Seat Foam and Geometrical Properties on BioRID P3 Kinematic Response to Rear Impacts,"* Traffic Injury Prevention, Vol. 4, Issue 4, pp 315-323, December 2003.

Singh, J., Welcher, J. and Perry, J., "*N-point Linear Interpolation of Motor Vehicle Crush Profiles Applied to Various Force-Shortening Models,"* International Journal of Crash Worthiness, 2003; 8: 321-328.

Welcher, J., *"Collision Trauma Biomechanics"* invited presentation and publication at ARC-CSI Crash Conference 2003.

NOT FOR EXPERT DESIGNATION

Welcher, J., *"Occupant Kinematics (Biomechanics)"* invited presentation and publication at Special Problems in Traffic Crash Reconstruction, Institute of Police Technology and Management (IPTM), presented at Breakout Sessions

Fugger, T., Randles, B., Welcher, J., and Szabo, T., *"Vehicle and Occupant Kinematics in Low- Speed Override/Underride Collisions,"* presented at the Society of Automotive Engineers International Congress and Exposition, March 2003. SAE Paper No. 2003-01-0158.

Singh, J., Welcher, J. and Perry, J., *"Effects of Mass and Stiffness Ratio Variation on Vehicle Speed Change and Closing Speed Calculations,"* presented at the Society of Automotive Engineers International Congress and Exposition, March 2003. SAE Paper No. 2003-01-0890.

Orange County American Board of Trial Advocates, "*Masters in Trial: A Trial Demonstration,"* Orange County, September 27, 2002. Presiding Judge Honorable Ray Ikola, Orange County Superior Court.

Szabo, T., Voss, D. and Welcher, J.: *"Influence of Seat Foam and Geometrical Properties on BioRID P3 Kinematic Response to Rear Impacts,"* proceedings of *2002 International IRCOBI Conference on the Biomechanics of Impact*, pp 87-101, Munich, Germany, September 18-20, 2002.

Orange County American Board of Trial Advocates, "*Masters in Trial: Technologies in the Courtroom,"* Chapman University School of Law, June 21, 2002.

Szabo, T., Voss, D. and Welcher, J., *"Relationship Between Impact Pulse Duration and Occupant Kinematics in Low Speed Rear Impacts,"* presented at the Society of Automotive Engineers International Congress and Exposition, March 4, 2002. Published in SP 1665. SAE Paper No. 2002-01-0029.

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Welcher, J. and Szabo, T., *"Relationship Between Seat Properties and Human Subject Kinematics in Rear-Impact Tests,"* Accident Analysis & Prevention, 33, pp 289-304, 2001.

Welcher, J*., "Admissibility of Biomechanical Testimony Under Daubert,"* Presented at the ANPAC 2001 SIU/MIST/Litigation Training Conference, Springfield, Missouri, June 8, 2001.

Welcher, J., "*Mitigating Whiplash Associated Disorders (WAD) Through Automotive Seat Design,"* 5th Annual Grodins Graduate Research Symposium, University of Southern California, Biomedical Engineering Department, April 30, 2001.

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Welcher, J., Szabo, T., and Voss, D., *"Human Occupant Motion in Rear-End Impacts: Effects of Incremental Increases in Velocity Change,"* presented at the Society of Automotive Engineers International Congress and Exposition, March 7, 2001. Published in SP 1572. SAE Paper No. 2001-01-0899.

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Carpenter, N. and Welcher, J., *"Stiffness and Crush Energy Analysis for Vehicle Collision and Its Relationship to Barrier Equivalent Velocity (BEV),"* presented at the Society of Automotive Engineers International Congress and Exposition, March 6, 2001. Published in SP 1572. SAE Paper No. 2001-01-0500.

Welcher, J., *"Occupant Modeling for Accident Reconstruction,"* presented at the Accident Reconstruction: State-of-the-Art TOTPEC, sponsored by the Society of Automotive Engineers (SAE) Continuing Professional Development Group, December 9-10, 1999. Published in the proceedings.

Welcher, J. and Szabo, T., *"Relationship Between Seat Properties and Human Subject Kinematics in Rear-Impact Tests,"* presented at the World Congress on Whiplash Associated Disorders (WAD), Vancouver, British Columbia, Canada, February 7-11, 1999. Published in the compendium of papers of the Traffic Safety and Auto Engineering Stream. Received the award for best paper in the Traffic Safety and Auto Engineering Stream for demonstrating innovation and excellence in research activities.

Szabo, T. and Welcher, J., *"Biomechanics of Low-Speed Impacts,"* presented and distributed at the International Association of Accident Reconstruction Specialists (IAARS) 1998 Conference, Boston, Massachusetts, July 13, 1998.

Anderson, R., Welcher, J., Szabo, T., Eubanks, J. and Haight, W., *"Effect of Braking on Human Occupant and Vehicle Kinematics in Low-Speed Rear-End Collisions,"* presented at the Society of Automotive Engineers International Congress and Exposition, February 1998. SAE Paper No. 980298 (In SAE Transactions).

Ojalvo, I., Weber, B., Evensen, D., Szabo, T. et al., *"Low Speed Car Impacts with Different Bumper Systems: Correlation of Analytical Model with Tests,"* published in Mechanisms of Protection (SP 1355). SAE Technical Paper 980365, 1998, doi:10.4271/980365.

Schmidt, B., Haight, W., Szabo, T. and Welcher, J., *"System-Based Energy and Momentum Analysis of Collisions,"* presented at the Society of Automotive Engineers International Congress and Exposition, February 1998. Published in Accident Reconstruction: Technology and Animation VIII (SP 1319). SAE Paper No. 980026 (In SAE Transactions).

Szabo, T. and Welcher, J., *"Recent Research on Low-Speed Collisions,"* presented at the Society of Forensic Engineers and Scientists meeting in Santa Barbara, California, October 18, 1997.

Welcher, J. and Szabo T., *"Introduction to Low-Speed Impacts,"* introductory section to Analysis of Low-Speed Collisions, an extension course for University Engineering Extension Services, Texas A&M University, College Station, Texas. Regularly updated since 1996.

Szabo, T. and Welcher, J., *"Human Subject Kinematics and Electromyographic Activity During Low Speed Rear Impacts,"* published in the Proceedings of the 40th Stapp Car Crash Conference (SP-305). SAE Paper No. 962432.

Szabo, T. and Welcher, J., *"Human Subject Response to Various Acceleration Fields,"* presented at the Low-Speed Collision TOPTEC, sponsored by SAE Continuing Professional Development Group, August 19-20, 1996. Published in the proceedings.

Vangsness, C., Heinsohn, R., Scharphuis, I., Schmotzer, H., Welcher, J. and Hedman, T., *"The In-Vitro Analysis of the Weight Bearing Kinematics of the Intact and ACL Deficient Knee,"* presented at the ACL Study Group Meeting, Nevis, West Indies, April 27-May 4, 1996. Also presented at the Annual Meeting of the University of Southern California Graduate Orthopaedic Society, June 20-21, 1996.

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Ward, C., Szabo, T. and Welcher, J., *"Recent Research on Rear-Impact Collisions,"* presented at the Low-Speed Rear-Impact Collision TOPTEC, sponsored by SAE Continuing Professional Development Group, August 8-9, 1994. Published in the proceedings.

Szabo, T., Welcher, J., Anderson, R., Rice, M., Ward, J., Paulo, L. and Carpenter, N., *"Human Occupant Kinematic Response to Low-Speed Rear-End Impacts,"* presented at the Society of Automotive Engineers International Congress and Exposition, March 1994. Published in Occupant Containment and Methods of Assessing Occupant Protection in the Crash Environment (SP 1045). SAE Paper No. 940532 (In SAE Transactions).

Rice, M., Welcher, J. and Ward, J., "*Comparative Analysis of Riot-Control Projectile Testing,*" presented at the American Academy of Forensic Sciences 46th Annual Meeting, San Antonio, Texas, February 1994. Abstracted in the proceedings.

Welcher, J. and Ward, J., "*The Rodney King Case: An Analysis of the Forces Produced from Baton Strikes,*" presented at the International Association of Forensic Sciences 13th Meeting, Düsseldorf, Germany, August 1993. Published in the proceedings.

"*Riot-Control Projectile Tests: Data Report,*" prepared for Sergeant George E. Haines of the Los Angeles Police Department, Metropolitan Division, July 1993.

"*Baton and Riot-Control Projectile Tests: Data Report,*" prepared for Sergeant George E. Haines of the Los Angeles Police Department, Metropolitan Division, April 1993.

Welcher, J., Ward, J. and Ward, C., "*Biomechanical Analysis of Forces Produced from Baton Strikes,*" presented at the American Academy of Forensic Sciences 45th Annual Meeting, Boston, Massachusetts, February 15-20, 1993. Abstracted in the proceedings.

Szabo, T. and Welcher, J., "*Dynamics of Low-Speed Crash Tests with Energy-Absorbing Bumpers,*" presented at the Future Transportation Technology Conference, Costa Mesa, California, August 1992. Published in Automobile Safety: Present and Future Technology (SP 925). SAE Paper No. 921573 (In SAE Transactions).

Welcher, J., "*Contribution of Energy-Absorbing (EA) Bumpers to Occupant Protection,*" presented at the American Academy of Forensic Sciences 44th Annual Meeting, New Orleans, Louisiana, February 17-22, 1992. Abstracted in the proceedings.

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