

David J. Lessley, Ph.D., P.E.

Curriculum Vitae

Biocore LLC
1627 Quail Run
Charlottesville, VA 22911
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Education\ Professional Certifications

PhD (*With Highest Distinction*) in Applied Medical Research, School of Medicine
University of Navarra (Pamplona, Spain), December 2011
Dissertation – *In-situ Measurement of Occupant Motion During Motor Vehicle Collisions:
Validity of Measures and Implications on the Prediction of Injuries*

BS in Mechanical Engineering, School of Engineering and Applied Science
(GPA 3.970, Rank 1 of 407)
University of Virginia, May 2001
Thesis – *Evaluating the Safety of Wheelchair Occupants During Motor Vehicle
Collisions*

Licensed Professional Engineer
Virginia – License # 0402044417

Professional Experience

Consultant 2014-Present
Biomechanics Consulting and Research (Biocore), LLC
Charlottesville, Virginia

University of Virginia - Center for Applied Biomechanics 2012-2019
Department of Mechanical and Aerospace Engineering
Research Scientist (Temporary and full-time assignments) – Performing applied biomechanics research and leading technical efforts related to complex biological biomechanics testing. Developing innovative test methodologies utilizing state-of-the-art instrumentation to quantify thoracic deformation and human skeletal motion occurring under a variety of loading conditions conducted under well-controlled laboratory conditions. Performing detailed post-test analysis to describe six degree-of-freedom motion of selected skeletal structures within the human body, such as the ribcage, shoulder complex, and spinal column. Collaborating with physicians, scientists, and

engineers to improve injury prediction capabilities used to guide safety countermeasures for human protection for vehicle occupants, pedestrians, athletes, and military personnel. Publishing research findings in medical and engineering journals and making professional presentations to the international injury biomechanics community.

University of Virginia - Center for Applied Biomechanics 2007-2012
Department of Mechanical and Aerospace Engineering

Senior Mechanical Engineer – Performing applied injury biomechanics research with the goal of improving injury prediction capabilities necessary to guide the design of safety countermeasures for human protection for a variety of persons, including vehicle occupants, military personnel, and athletes. Research focus includes the study of dynamic forces acting on the human body during impact loading, characterizing human impact response, the study of injury mechanism, and investigating the relationship between dynamic forces acting on the human body and resulting injury. Specialized skills and experience include conducting full-scale biomechanical tests with human surrogates, analyzing human mechanical response using state of the art instrumentation, developing data processing algorithms, and assessing soft and hard tissue injury. Responsibilities include leading biological testing and data analysis efforts associated with complex and highly instrumented biomechanical tests. Additional responsibility includes disseminating research findings through detailed technical reports, peer-reviewed publications, and oral presentations to the international injury biomechanics community.

University of Virginia - Center for Applied Biomechanics 2001-2007
Department of Mechanical and Aerospace Engineering

Research Engineer (Laboratory and Research Specialist) - Performing applied injury biomechanics research including the study of dynamic forces acting on the human body during impact loading, characterizing human impact response, the study of injury mechanism, and investigating the relationship between dynamic forces acting on the human body and resulting injury. Specialized skills and experience include conducting full-scale biomechanical tests with human surrogates, analyzing human mechanical response using state of the art instrumentation, developing data processing algorithms, assessing soft and hard tissue injury, and disseminating research findings through detailed technical reports, peer-reviewed publications, and oral presentations to the international injury biomechanics community.

University of Virginia – Center for Applied Biomechanics 2000-2001
National Science Foundation Intern – Developed a validated MADYMO computational model and applied it to the optimization of restraint design for wheelchair-seated occupants in crashes.

Blue Ridge Community College 1997-1998
Tutor of Mathematics

McQuay International – Engineering Test Laboratory 1997-1998
Intern – Conducted controlled laboratory product performance tests.

McKee Foods Corporation 1991 – 1996
Heavy Equipment Operator and Licensing Instructor – Operated on-site combination vehicles and loading equipment. Provided safety training and licensing evaluations for operator trainees.

Honors/Awards

- Excellent Technical Paper Presentation Award - Society of Automotive Engineers of Japan Annual Congress, Yokohama, Japan 2012
- Passed Principals and Practice of Engineering Exam, April 2008
- Excellence in Oral Presentation – Society of Automotive Engineers World Congress, 2004
- University of Virginia Z Society Shannon Award for the School of Engineering and Applied Science, 2001 – Awarded to the graduating student from the School of Engineering and Applied Science with the highest GPA.
- Passed Fundamentals of Engineering Exam, May 2001
- University of Virginia Chairperson’s Mechanical Engineering Senior Award, 2000-2001
- University of Virginia Chairperson’s Mechanical Engineering Junior Award, 1999-2000

Research Focus/Experience

- Characterizing the mechanical response of biological materials and structures
- Conducting biomechanical impact testing with human cadavers and crash test dummies
- Analyzing human mechanical response to a variety of loading conditions using state of the art sensors and instrumentation
- Developing a novel methodology that incorporates motion capture technology with surgically implanted measurement hardware to obtain six degree-of-freedom motion of human skeletal structures during a variety of impact scenarios.
- Developing post processing algorithms to analyze detailed skeletal motions such as spinal kinematics and ribcage deformation
- Studying kinematics and kinetics associated with dynamic impact loading
- Studying mechanism of injury under impact loading
- Predicting risk of injury and developing injury risk functions
- Evaluation and assessment of crash test dummy performance and biofidelity
- Assessing occupant restraint performance

Professional Society Involvement/Activities

- Panel of Reviewers, American Journal of Sports Medicine
- Panel of Reviewers, Journal of Biomechanics
- Panel of Reviewers, SAE World Congress
- Non-Advocate Review Panel, NASA Human Research Program
- Panel of Reviewers, Journal of Sports Biomechanics
- Panel of Reviewers, Journal of Footwear Science
- Society of Automotive Engineers
- National Society of Professional Engineers
- Virginia Society of Professional Engineers
- International Society of Biomechanics

Publications

A. Refereed Journal Publications

- A1. Lessley, D., Kent, R., Cormier, J., Sherwood, C., Funk, J., Crandall, J., Myers, B., Arbogast, K. (2020) Position-Specific Circumstances of Concussions in the NFL: Toward the Development of Position-Specific Helmets. *Ann. Biomed. Eng.* 48(11):2542-2554. DOI: 10.1007/s10439-020-02657-z
- A2. Gabler, L., Huddleston, S., Dau, N., Lessley, D., Arbogast, K., Thompson, X., Resch, J., Crandall, J. (2020) On-Field Performance of an Instrumented Mouthguard for Detecting Head Impacts in American Football. *Ann. Biomed. Eng.* 48(11):2599-2612. DOI: 10.1007/s10439-020-02654-2.
- A3. Elbin, RJ., Zuckerman, SL., Sills, AK., Crandall, JR., Lessley, DJ., Solomon, GS. (2020) Sensitivity and Specificity of On-Field Visible Signs of Concussion in the National Football League. *Neurosurgery*, nyaa072, <https://doi.org/10.1093/neuros/nyaa072>.
- A4. Zuckerman, SL., Elbin, RJ., Sills, AK., Crandall, JR., Lessley, DJ., Moran, CM., Moran, CD., Solomon, GS. (2020) Concussions in the National Football League: the evolution of video review for assessing the frequency and reliability of visible signs. *The Physician and Sportsmedicine*, DOI: 10.1080/00913847.2020.1731379
- A5. Joodaki, H., Bailey, A., Lessley, D., Funk, J., Sherwood, C., Crandall, J. (2019) Relative Motion between the Helmet and Head in Football Impact Test. *Journal of Biomechanical Engineering*, 141(8). DOI: 10.1115/1.4043038
- A6. Lessley, D., Kent, R., Funk, J., Sherwood, C., Cormier, J., Crandall, J., Arbogast, K., and Myers, B. (2018) Video analysis of reported concussion events in the National Football League during the 2015-2016 and 2016-2017 seasons. *Am. J. Sports Med.* 46(14):3502-3510, 2018. DOI: 10.1177/0363546518804498

- A7. Bailey, A., Funk, J., Lessley, D., Sherwood, C., Crandall, J., Neale, W., and Rose, N. (2018) Validation of a videogrammetry technique for analysing American football helmet kinematics. *Sports Biomechanics*, DOI: 10.1080/14763141.2018.1513059
- A8. Shaw, CG. Lessley, DJ. Ash, JH. Acosta, S. Heltzel, SB. Riley, PO. Kim, T. Crandall, JR. (2018) Pelvic restraint cushion sled test evaluation of pelvic forward motion. *Traffic Injury Prevention*, 19(3): 250-255.
- A9. Jastifer J., Kent RW., Crandall JR., Sherwood CP., Lessley DJ., McCullough KA., Coughlin MJ., Anderson RB. (2017) The Athletic Shoe in Football. *Sports Health*. 9(2): 126-131.
- A10. Shaw CG., Lessley DJ., Ash JH., Poplin J., McMurry TL., Sochor MR., Crandall JR. (2017) Small female rib cage fracture in frontal sled tests. *Traffic Injury Prevention*, 18(1): 77-82.
- A11. Lessley, D., Crandall J., Frederick, E., Kent, R., Sherwood, C. (2016) Quantifying the forefoot bending stiffness of cleated American football shoes using the Football American Shoe Tester (FAST). *Footwear Science*, DOI: 10.1080/19424280.2016.1165742
- A12. Kim, T., Shaw, CG., Lessley, DJ., Park, G., Crandall, JR., Svendsen, A., Whitcomb, B., Ayyagari, M., Mishra, P., Markusic, C. (2016) Biofidelity evaluation of WorldSID and ES-2re under side impact conditions with and without airbag. *Accident Analysis and Prevention*, 90: 140-151.
- A13. Crandall, J., Frederick, E., Kent, R., Lessley, D., Sherwood, C. (2015) Forefoot bending stiffness of cleated American football shoes. *Footwear Science* (in press) DOI: 10.1080/19424280.2015.1058427
- A14. Kent, R., Forman, J., Lessley, D., Crandall, J. (2015) The mechanics of American football cleats on natural grass and infill-type artificial playing surfaces with loads relevant to elite athletes. *Sports Biomechanics* (Impact Factor 0.762) (in press) DOI: 10.1080/14763141.2015.1052749.
- A15. Forman, J., Perry, B., Henderson, K., Gjolaj, J.P., Heltzel, S., Lessley, D., Riley, P., Salzar, R., Walilko, T. "Blunt Impacts to the Back: Biomechanical Response for Model Development (2015). *Journal of Biomechanics*. (In Press). DOI: <http://dx.doi.org/10.1016/j.jbiomech.2015.06.035>
- A16. Kent, R., Forman, J., Lessley, D., Crandall, J. (2015) The mechanical interactions between an American football cleat and playing surfaces *in-situ* at loads and rates generated by elite athletes: a comparison of playing surfaces. *Sports Biomechanics* (Impact Factor 0.762) 14(1):1-17 DOI: 10.1080/14763141.2015.1024277.
- A17. Forman, JL., Joodaki, H., Forghani, A., Riley, PO., Bollapragada, V., Lessley, DJ., Overby, B., Heltzel, S., Kerrigan, JR., Crandall, JR., Yarboro, S., Weiss, DB. (2015)

- Whole-body Response for Pedestrian Impact with a Generic Sedan Buck. *Stapp Car Crash Journal*, 59: 401-444.
- A18. Donoln, JP., Poulard, D., Lessley, D.J., Riley, P., Subit, D. (2014) Understanding how pre-impact posture can affect injury outcome in side impact sled tests using a new tool for visualization of cadaver kinematics. *Journal of Biomechanics*. Volume 48, Issue 3, pages 529-533. DOI: <http://dx.doi.org/10.1016/j.jbiomech.2014.12.042>.
- A19. Lessley, DJ, Riley, PO, Zhang, Q, Foltz, P, Overby, B, Heltzel, S, Sochor, M, Crandall, JR, Kerrigan, JR. (2014) Occupant Kinematics in Laboratory Rollover Tests: PMHS Response. *Stapp Car Crash Journal*, 58: 251-316.
- A20. Zhang, Q, Lessley, DJ, Riley, PO, Toczyski, J, Lockerby, J, Foltz, P, Overby, B, Seppi, J, Crandall, JR, Kerrigan, JR. (2014) Occupant Kinematics in Laboratory Rollover Tests: ATD Response and Biofidelity *Stapp Car Crash Journal*, 58: 317-360.
- A21. Poulard, D., Subit, D., Donlon, J., Lessley, D., Kim, T., Park, G., Kent, R. (2014). The contribution of pre-impact spine posture on human body model response in side impact. *Stapp Car Crash Journal* 58:385-422.
- A22. Crandall, JR, Lessley, DJ, Shaw, CG, Ash, JH. (2014) Displacement response of the spine in restrained PMHS during frontal impacts. *JSAE International Journal of Automotive Engineering*, 5(2): 59-64.
- A23. Shaw, CG, Lessley, DJ, Ash, JH, Crandall, JR. (2014) Development of an Alternative Frontal Impact Condition to Assess Thoracic Response Using Thor Mod Kit Dummy. *JSAE International Journal of Automotive Engineering*, 5: 39-46.
- A24. Lessley, DJ, Shaw, CG, Ash, JH, Crandall, JR. (2014) A Methodology for Assessing Intrasegmental Kinematics of the Whole Human Spine during Impacts. *JSAE International Journal of Automotive Engineering*, 5(14): 1-6.
- A25. Shaw, G, Lessley, D, Ash, J, Sochor, M, Crandall, J, Luzon-Narro, J, Arregui-Dalmases. (2014) Side impact PMHS thoracic response with large volume airbag. *Traffic Injury Prevention*. (In Press). DOI:10.1080/15389588.2013.792109.
- A26. Lopez-Valdes FJ, Riley PO, Lessley DJ, Arbogast KB, Seacrist T, Balasubramanian S, Maltese M, Kent R. (2014). The six degree-of-freedom motion of the human head, spine and pelvis in a frontal impact. *Traffic Injury Prevention*. DOI: 10.1080/15389588.2013.817668.
- A27. Forman, J, Lopez-Valdes, F, Lessley, D, Riley, P, Sochor, M, Heltzel, S, Ash, J, Perz, R, Kent, R, Seacrist, T, Arbogast, K, Tanji, H, Higuchi. (2013). Occupant kinematics and shoulder belt retention in far-side lateral and oblique collisions: a parametric study. *Stapp Car Crash Journal*. Volume 57, pages 343-385.

- A28. Ash, J, Shaw, G, Lessley, D, Crandall, J. (2013) PMHS Restraint and Support Surface Forces in Simulated Frontal Crashes. *International Journal of Automotive Engineering*. 4(2):41-46 (20134101).
- A29. Salzar, R., Lau, S., Lessley, D., Sochor, M., Shaw, G., Kent, R., Crandall, J. (2013) Thoracic response to shoulder-belt loading: comparison of table-top and frontal sled tests with PMHS. *Traffic Injury Prevention*. 14(2):159-167 DOI: 10.1080/15389588.2012.692223.
- A30. Kent, R., Lopez-Valdes, F., Lamp, J., Lau, S., Parent, D., Kerrigan, J., Lessley, D., Salzar, R., Sochor, M., Bass, D., Maltese, M. (2012) Biomechanical response targets for physical and computational models of the pediatric trunk. *Traffic Injury Prevention*. 13(5):499-506.
- A31. Kent, R, Crandall, J, Forman, J, Lessley, D, Lau, A, Garson, C. (2012) Development and assessment of a device and method for studying the mechanical interactions between shoes and playing surfaces in-situ at loads and rates generated by elite athletes. *Sports Biomechanics*. 11(3):414-429.
- A32. Untaroiu, C.D., Bose, D., Lu, Y-C, Riley P., Lessley D., Sochor M. (2012) Effect of seat belt pretensioners on human abdomen and thorax: biomechanical response and risk of injuries. *The Journal of Trauma: Injury, Infection, and Critical Care*. 72(5):1304-1315. DOI: 10.1097/TA.0b013e3182472390
- A33. P. O. Riley, C. Arregui-Dalmases, S. Purtserov, D. Parent, D. J. Lessley, G. Shaw, J. Crandall, Shinichi Takayama, Koshiro Ono, Koichi Kamiji & Tsuyoshi Yasuki (2011). Kinematics of the unrestrained vehicle occupants in side-impact crashes. *Traffic Injury Prevention*. *Traffic Injury and Prevention*. 13(2):163-71. doi: 10.1080/15389588.2011.637251.
- A34. Lessley D, Shaw G, Riley P, Forman J, Crandall J (2011) Assessment and Validation of a Methodology for Measuring Anatomical Kinematics of Restrained Occupants During Motor Vehicle Collisions. *J Biosens Bioelectron* S1:002. doi: 10.4172/2155-6210.S1-002.
- A35. Kent, R, Lopez-Valdes, F, Dennis, N, Forman, J, Lessley, D, Higuchi, K, Tanji, H, Ato, T, Kameyoshi, H, Arbogast, K. (2011). Assessment of a Three-Point Restraint System with a Pre-tensioned Lap Belt and an Inflatable, Force-Limited Shoulder Belt. *Stapp Car Crash Journal*. Nov;55:141-59.
- A36. Parent, D. P., Shaw, C. G., Lessley, D. J., Bolton, J. R., Arregui-Dalmases, C., Purtsezov, S., Riley, P. O., Crandall, J. R., Takayama, S., Ono, K., Kamiji, K., Yasuki, T. External Biofidelity in Lateral Impact: Measurement of Global and Local Forces. (2011) *International Journal of Crashworthiness*. 16(6): 677-689.
- A37. Duprey S., Subit D., Lessley D., Guillemot H., Kent R., In vitro kinematics of the shoulder: comparison with in vivo data during arm flexion. *Computer Methods in Biomechanics and Biomedical Engineering*, 2011, vol.14(S1), pp.193-194.

- A38. C Arregui-Dalmases, E Del Pozo, S Stacey, M Kindig, D Lessley, F Lopez-Valdes, J Forman, R Kent. (2011) Pressure waves in the aorta during isolated abdominal belt loading: the magnitude, phasing, and attenuation. *Journal of Engineering in Medicine* (225): 688-695.
- A39. Arregui-Dalmases, C, Del Pozo, E, Lessley, D, Segui-Gomez, M, Manuel, J, Nombela, M, Cisneros, O, Luis de Miguel, J. (2011) Driving position field study, differences with the whiplash protocol and biomechanics experimental responses. *Proc. Of the Association for the Advancement of Automotive Medicine*. 55:231-41.
- A40. Sunnevang, C, Bostrom, O, Subit, D, Kindig, M, Lessley, D, Lamp, J, Kent, R. (2011) Response of the Worldwide Side Impact Dummy (WorldSID) to localized constant-speed impacts. *Proc. Of the Association for the Advancement of Automotive Medicine*. 55:231-41.
- A41. Lessley, D., Shaw, G., Parent, D., Arregui-Dalmases, C., Kindig, M., Riley, P., Purtsezov, S., Sochor, M., Gochenour, T., Bolton, J., Subit, D., Crandall, J., Takayama, S., Ono, K., Kamiji, K., Yasuki, T. (2010) Whole-Body Response to Pure Lateral Impact. *Stapp Car Crash Journal*. Nov;54:289-336.
- A42. Subit, D., Duprey, S., Lau, S., Guillemont, H., Lessley, D., Kent, R. (2010) Response of the Human Torso to Lateral and Oblique Constant-Velocity Impacts. *Proc. of the Association for the Advancement of Automotive Medicine*. 54:27-40.
- A43. Lopez-Valdes, F. J., Lau, A., Lamp, J., Riley, P. O., Lessley, D. J., Damon, A., Kindig, M., Kent, R. W., Balasubramanian, S., Seacrist, T., Maltese, M. R., Arbogast, K. B., Higuchi, K., Tanji, H. (2010) Analysis of Spinal Motion During Frontal Impacts. Comparison between PMHS and ATD. *Proc. of the Association for the Advancement of Automotive Medicine*. 54:61-78.
- A44. Lamp, J., Lessley, D. J., Kent, R. W. (2010) Expansion and Evaluation of Data Characterizing the Structural Behavior of the Pediatric Abdomen. *Proc. of the Association for the Advancement of Automotive Medicine*. 54:89-96.
- A45. Lessley, D. J., Salzar, R. S., Crandall, J. R., Kent, R.W., Bass, C. R., Guillemot, H., Forman, J. L. (2010) Kinematics of the Thorax under Dynamic Belt Loading Conditions. *International Journal of Crashworthiness*. 15(2):175-190.
- A46. Damon, A. M., Lessley, D. J., Salzar, R. S., Bass, C. R., Shen, F. H., Paskoff, G. R., Shender, B. S. (2010) Kinematic Response of the Spine During Aircraft Ejections. *Aviation Space & Environmental Medicine*. *Aviat Space Environ Med*. May;81(5):453-9.
- A47. Forman, J. L., Lopez-Valdez, F., Lessley, D. J., Kindig, M., Kent, R. W., Kuppa, S., Bostrom, O. (2009) Rear Seat Occupant Safety; An Investigation of a Progressive Force-Limiting, Pretensioning 3-Point Belt System Using Adult PMHS in Frontal Sled Tests. *Stapp Car Crash Journal*. Nov;53:49-74.

- A48. Forman, J. L., Lopez-Valdez, F., Lessley, D. J., Kindig, M., Kent, R. W., Bostrom, O. (2009) The Effect of Obesity on the Restraint of Automobile Occupants. *Proc. of the Association for the Advancement of Automotive Medicine*. 53:25-40.
- A49. Kent, R. W., Salzar, R. S., Kerrigan, J. K., Parent, D., Lessley, D. J., Sochor, M., Luck, J., Loyd, A., Song, Y., Nightingale, R., Bass, C. R., Maltese, M. R. (2009) Pediatric Thoracoabdominal Biomechanics. *Stapp Car Crash Journal*. Nov;53:373-401.
- A50. Shaw, G., Parent, D., Purtsezov, S., Lessley, D., Crandall, J., Kent, R., Guillemot, H., Ridella, S. A., Takhounts, E., Martin, P. (2009) Impact Response of Restrained PMHS in Frontal Sled Tests: Skeletal Deformation Patterns Under Seat Belt Loading. *Stapp Car Crash Journal*. Nov;53:1-48.
- A51. Salzar, R. S., Bass, C. R., Lessley, D., Crandall, J. R., Kent, R. W., Bolton, J. R. (2009) Viscoelastic Response of the Thorax Under Dynamic Belt Loading. *Traffic Injury and Prevention*, 10:1-8
- A52. Crandall, J. R., Lessley, D. J., Kerrigan, J. R., Ivarsson, B. J. (2006) Thoracic Deformation Response of Pedestrians Resulting from Vehicle Impact. *International Journal of Crashworthiness*, 11(6): 529-539.
- A53. Forman, J., Lessley, D. J., Kent, R. W., Bostrom, O., Pipkorn, B. (2006) Whole-body Kinematic and Dynamic Response of Restrained PMHS in Frontal Sled Tests. *Stapp Car Crash Journal* 50: 299-336.
- A54. Forman, J., Lessley, D. J., Shaw, C. G., Evans, J., Kent, R. W., Rouhana, S., Prasad, P. (2006) Thoracic Response of Belted PMHS, the Hybrid III, and the THOR-NT Mid-Sized Male Surrogates in Low Speed, Frontal Crashes. *Stapp Car Crash Journal*, 50: 191-215.
- A55. Ivarsson, B. J., Kerrigan, J. R., Lessley, D. J., Drinkwater, D. C., Kam, C. Y., Murphy, D. B., Crandall, J. R., Kent, R. W. (2005) Dynamic Response Corridors of the Human Thigh and Leg in Non-Midpoint Three-Point Bending. *SAE Transactions: Journal of Passenger Cars-Mechanical Systems*, 114(6): 193-204.
- A56. Shaw, C. G., Lessley, D. J., Crandall, J. R., Kent, R. W. (2005) Elimination of Thoracic Muscle Tensing Effects for Frontal Crash Dummies. *SAE Transactions: Journal of Passenger Cars-Mechanical Systems*, 114(6): 205-219.
- A57. Kent, R. W., Lessley, D. J., Sherwood, C. (2004) Thoracic Response to Dynamic, Non-Impact Loading from a Hub, Distributed Belt, Diagonal Belt, and Double Diagonal Belts. *Stapp Car Crash Journal*, 48:495-519.
- A58. Kent, R. W., Lessley, D. J., Shaw, C. G., Crandall, J. R. (2003) The Utility of Hybrid III and THOR Chest Deflection for Discriminating Between Standard and Force-limiting Belt Systems. *Stapp Car Crash Journal*, 47:267-297.

- A59. Kent, R. W., Shaw, C. G., Lessley, D. J., Crandall, J. R., Kallieris, D., Svensson, M. (2003) Comparison of Belted Hybrid III, THOR, and Cadaver Thoracic Responses in Oblique Frontal and Full Frontal Sled Tests. SAE Transactions, 112(6): 71-84.
- A60. Kent, R. W., Crandall, J. R., Rudd, R. W., Lessley, D. J. (2002) Load Distribution-Specific Viscoelastic Characterization of the Hybrid III Chest. SAE Transactions: Journal of Passenger Cars - Mechanical Systems, 111(6): 199-210.

B. Refereed Conference Publications

- B1. Acosta SM., Ash JH., Lessley DJ., Shaw CG., Heltzel SB., Crandall JR. (2016) Comparison of Whole Body Response in Oblique and Full Frontal Sled Tests. Proceedings of the International Research Council on the Biomechanics of Impact (IRCOBI). Malaga, Spain, September 14-16.
- B2. Forman, J., Joodaki, H., Forghani, A., Riley, P., Bollapragada, V., Lessley, D., Overby, B., Heltzel, J., Crandall, J. (2015) Biofidelity Corridors for Whole-Body Pedestrian Impact with a Generic Buck. IRCOBI, 2015. Lyon, France (In Press).
- B3. Toczyski, J., Lessley D.J., Zhang, Q., Kerrigan, J. (2015) Short communication: Occupant Motion Tracking in Rollover using 3D Optical Systems. IRCOBI, 2015. Lyon, France (In Press).
- B4. Kim, T, Shaw, CG, Lessley, DJ, Park, G, Crandall, JR, Markusic, C, Svendsen, A, Saunders, N, Sunnevang, C. (2014) Evaluation of Biofidelity of WorldSID and ES-2re under side impact conditions with and without an airbag. Proceedings of the International Crashworthiness Conference, Kuching, Malaysia.
- B5. Zhang, Q, Kerrigan, J, Lessley, D, Seppi, J, Riley, P, Foltz, P, Lockerby, J, Overby, B, Sowers, C, Crandall, J. (2013) Whole-body kinematics: response comparison of the Hybrid III and Hybrid III pedestrian ATD in DRoTS rollover tests. IRCOBI Conference on the Biomechanics of Impact. Gothenburg, Sweden.
- B6. Ash, J, Lessley, D, Forman, J, Zhang Q, Shaw, C, Crandall, J. (2012) Whole-Body Kinematics: Response Corridors for Restrained PMHS in Frontal Impacts. IRCOBI Conference on the Biomechanics of Impact. Dublin, Ireland.
- B7. Salzar, R, Lessley, D, Sochor, M, Shaw, G, Kent, R, Crandall, J. (2011) Thoracic Response to Shoulder-Belt Loading: Comparison of Table-Top and Frontal Sled Tests with PMHS. International Research Council on the Biomechanics of Impact (IRCOBI). Krakow, Poland.
- B8. Untaroiu, C, Bose, D, Lu, Y, Riley, P, Lessley, D, Sochor, M. (2011). Abdominal and thoracic response to loading of pretensioner restraint systems. International Research Council on the Biomechanics of Impact (IRCOBI). Krakow, Poland.

- B9. Kent, R, Forman, J, Lessley, D, Crandall, J. (2011) Characterization of Athletic Shoe-Surface Mechanics in situ at Loads and Rates Relevant to Game Situations. International Research Council on the Biomechanics of Impact (IRCOBI). Krakow, Poland.
- B10. Shaw, G., Parent, D., Purtsezov, S., Lessley, D., Crandall, J., Tornvall, F. (2010) Torso Deformation in Frontal Sled Tests: Comparison Between THOR NT, THOR NT with the Chalmers SD-1 Shoulder, and PMHS. International Research Council on the Biomechanics of Impact (IRCOBI). Hanover, Germany.
- B11. Shaw, C. G., Parent, D., Pursezov, S., Lessley, D., Shin, J., Crandall, J. R., Zama, Y., Ejima, S., Kamiji, K., Yasuki, T. (2009) Frontal Impact PMHS Sled Tests for FE TORSO Model Development. International Research Council on the Biomechanics of Impact (IRCOBI). York, United Kingdom.
- B12. Lessley, D. J., Kent, R. W., Crandall, J. R., Salzar, R. S., Shaw, C. G. (2009) Internal vs. External Chest Deformation Response to Shoulder Belt Loading, Part 1: Table-Top Tests. Paper 2009-01-0393, Society of Automotive Engineers.
- B13. Shin, J., Lessley, D. J., Untaroiu, C. D., Crandall, J. R. (2009) Thoracic Response to Shoulder Belt Loading using Experimental and Computational Analyses: Chest Stiffness Investigation of Ribcage. Paper 2009-01-0384 , Society of Automotive Engineers.
- B14. Salzar, R. S., Bass, C. R., Lessley, D. J., Crandall, J. R., Kent, R. W., Bolton, J. R. (2008) Viscoelastic Response of the Thorax under Dynamic Belt Loading. International Research Council on the Biomechanics of Impact (IRCOBI). Bern, Switzerland.
- B15. Shaw, C. G., Lessley, D. J., Evans, J., Crandall, J. R., Shin, J., Portier, P., Paoloni, G. (2007) Quasi-static and Dynamic Thoracic Loading Tests: Cadaveric Torsos. International Research Council on the Biomechanics of Impact (IRCOBI). Maastricht, The Netherlands.
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- B21. Kent, R. W., Lessley, D. J., Shaw, C. G., Crandall, J. R. (2003) The Utility of Hybrid III and THOR Chest Deflection for Discriminating Between Standard and Force-limiting Belt Systems. Paper 2003-22-0013, Society of Automotive Engineers.
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- B23. Kent, R. W., Sherwood, C. P., Lessley, D. J., Overby, B., Matsuoka, F. (2003) Age-related Changes in the Effective Stiffness of the Human Thorax using Four Loading Conditions. IRCOBI Conference on the Biomechanics of Impact. Lisbon, Portugal.

C. Other publications

- C1. Donlon, JP, Joodaki, H, Toczyski, J, Lessley, DJ, Forman, JL. (2016) Biofidelity Corridors using Arc-Length Parametrization. International Workshop on Human Subjects for Biomechanical Research, 44, National Highway Traffic Safety Administration, US DOT.
- C2. Toczyski, J, Zhang, Q, Lessley, DJ, Kerrigan, JR. (2015) Biofidelity of Dummies in Rollover Crash Impacts. International Workshop on Human Subjects for Biomechanical Research, 43, National Highway Traffic Safety Administration, US DOT.
- C3. Crandall, J., Frederick, E., Kent, R., Lessley, D., Sherwood, C. (2015) Apparatus for measuring the forefoot bending stiffness of cleated American football shoes. Proc. XII Footwear Biomechanics Symposium (Liverpool 2015), (edited by T. Arndt, W. Potthast), Footwear Science Vol. 7 Issue S1 p S23-S25.
- C4. Lessley, DJ, Riley, PO, Zhang, Q, Foltz, P, Lockerby, J, Seppi, J, Overby, B, Sochor, MR, Crandall, JR, Kerrigan, JR. (2013) Whole-Body Kinematics in Dynamic Rollover Tests: A Comparison of PMHS Responses for Leading-Side and Trailing-Side Front-Row Seating Positions. International Workshop on Human Subjects for Biomechanical Research, 41, National Highway Traffic Safety Administration, US DOT.
- C5. Kent, R, Forman, J, Lessley, D, Arbogast, K, Higuchi, K. (2013) A parametric study of far-side restraint mechanics. Enhanced Safety of Vehicles Conference. Paper #13-0381. Seoul, Republic of Korea.
- C6. Shaw, G, Lessley, D, Ash, J, Crandall, J, Parent, D. (2013) Response comparison for the Hybrid III, THOR mod kit with SD-3 shoulder, and PMHS in a simulated frontal crash. Enhanced Safety of Vehicles Conference. Paper #13-0130. Seoul, Republic of Korea.

- C7. Park, G, Kim, T, Ash, J, Lessley, D, Shaw, G, Crandall, J. (2013) Evaluation of ES-2re dummy FE model under side impact sled tests with side airbag condition. The Ohio State University's 9th Annual Injury Biomechanics Symposium (Poster presentation) (Columbus, OH).
- C8. Kent, R, Forman, J, Lessley, D, Arbogast, K, Higuchi, K. (2013) Oblique and Far-Side PMHS Experiments. Japan Society of Automotive Engineers. Paper #20135115. Yokohama, Japan
- C9. Lessley, D, Shaw, G, Ash, J, Crandall, J. (2012) A Methodology for Assessing Intrasegmental Kinematics of the Whole Human Spine During Impacts. Japan Society of Automotive Engineers. Paper #20125179. Yokohama, Japan
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- C11. Crandall, J, Lessley, D, Shaw, G, Ash, J. (2012) Displacement Response of the Spine in Restrained PMHS During Frontal Impacts. Japan Society of Automotive Engineers. Paper #20125182. Yokohama, Japan
- C12. Shaw, G, Lessley, D, Ash, J, Crandall, J. (2012) Development of an Alternative Frontal Impact Condition to Assess Thoracic Response Using the THOR Mod Kit Dummy. Japan Society of Automotive Engineers. Paper # 20125216. Yokohama, Japan
- C13. Ash, J, Shaw, G, Lessley, D, Crandall, J. (2012) PMHS Restraint and Support Surface Forces in Simulated Frontal Crashes. Japan Society of Automotive Engineers. Paper # 20125221. Yokohama, Japan
- C14. Lessley, D. (2011). In-situ Measurement of Occupant Motion During Motor Vehicle Collisions: Validity of Measures and Implications on the Prediction of Injuries. University of Navarra School of Medicine. Pamplona, Spain. Dissertation.
- C15. Bose, D, Lessley, D, Crandall, J, Arregui-Dalmases, C, Luzon, J. (2011) Biomecánica del impacto aplicada al accidente de tráfico. ETRASA - Editorial Tráfico Vial, S.A. 978-84-92625-40-6. Pp 73-98.
- C16. Kent, R, Lopez-Valdes, F, Lamp, J, Lau, S, Parent, D, Kerrigan, J, Lessley, D, Salzar, R. (2011) Characterization of the pediatric chest and abdomen using three post-mortem human subjects. Enhanced Safety of Vehicles Conference. Paper #11-0394. Washington D.C., USA.
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- C18. Li, Z, Lessley, D, Crandall, J, Kent, R. (2010). Evaluation of deflection-based predictors for estimating thoracic injury risk. Proceedings of the Thirty-Eighth International Workshop on Injury Biomechanics Research, Scottsdale, AZ.
- C19. Parent, D. P., Shaw, C. G., Lessley, D. J., Riley, P. O., Crandall, J. R., Takayama, S., Ono, K., Kamiji, K., Yasuki, T. External Biofidelity in Lateral Impact: Measurement of Global and Local Forces. 2010 International Crashworthiness Conference. Washington D.C., USA.
- C20. Shaw, G., Bolton, J., Lessley, D., Parent, D., Riley, P. (2010) Improved Method to Record the Response of Seated Live Human Surrogates in a Simulated Side Impact. Proceedings of the 2010 JSAE Annual Congress, PACIFICO, YOKOHAMA, Paper 455-20105080.
- C21. Bose, D., Pipkorn, B., Crandall, J. R., Lessley, D. J., Trowbridge, M. J. (2009) Multi-point Thoracic Deflection Measurement as a Predictor of Rib Injury in Frontal Collision, Proceedings of the Thirty-Seventh International Workshop on Injury Biomechanics Research, Savannah, USA.
- C22. Lessley, D. J., Shaw, C. G, Parent, D., Purtsezov, S., Riley, P., Crandall, J. R. (2009) Assessment and Validation of a Methodology for Measuring Anatomical Kinematics Under Impact Loading. 37th International Workshop on Human Subjects for Biomechanics Research, Savannah, USA.
- C23. Lopez-Valdez, F., Kent, R. W., Shaw, C. G., Lessley, D. J., Tanji, H., Higuchi, K. (2009) Optical Measurement of 6-DOF kinematics of Internal Body Structures During Frontal Impact Restraint Loading, paper 20095066, Japan Society of Automotive Engineers.
- C24. Lessley, D. J., Salzar, R. S., Crandall, J. R., Kent, R.W., Bass, C. R., Forman, J. (2008) Kinematics of the Thorax under Dynamic Belt Loading Conditions. Proceedings of the International Crashworthiness Conference, Kyoto, Japan.
- C25. Untaroiu, C. D., Shin, J., Shaw, C. G., Lessley, D. J., Crandall, J. R. (2008) Thoracic Response Under Dynamic Mid-sternal Compressive Loading: Finite Element Investigation of Thoracic Stiffness. Southeastern Meeting of the American Society of Biomechanics.
- C26. Crandall, J. R., Lessley, D. J., Kerrigan, J. R., Ivarsson, B. J. (2006) Thoracic Deformation Response of Pedestrians Resulting from Vehicle Impact. Proceedings of the International Crashworthiness Conference, Athens, Greece.
- C27. Shaw, C. G., Lessley, D. J., Bolton, J. R., Crandall, J. R., Belford, L., Hunter, J. (2005) Sled Test Trials of 3-D Point Tracking System. 33rd International Workshop on Human Subjects for Biomechanical Research.
- C28. Shaw, C. G., Lessley, D. J., Kent, R. W., Crandall, J. R. (2005) Dummy Torso Response to Anterior Quasi-Static Loading. Paper 05-0371, Proceedings of the 19th International Technical Conference on the Enhanced Safety of Vehicles (ESV).

- C29. Lessley, D. J., Crandall, J. R., Kent, R. W., Shaw, C. G. (2003) Normalization Technique for Developing Corridors for Individual Subject Force-Deflection Responses. 31st International Workshop on Human Subjects for Biomechanical Research.
- C30. Lessley, D. (2001) Evaluating the Safety of Wheelchair Occupants During Motor Vehicle Collisions. Undergraduate thesis published by the Department of Mechanical and Aerospace Engineering, School of Engineering and Applied Science, University of Virginia.
- C31. Lau, S. H., Lopez-Valdes, F. J., Lau, A. G., Lessley D. J., Feldmen, S. H., Kent, R. W. (2010) Assessment of a Biological Model of a Human Child in a Frontal Impact Environment. Association for the Advancement of Automotive Medicine Student Symposium. Las Vegas, Nevada.

D. Books and Book Chapters

- D1. Bose, D, Lessley, DJ, Crandall, JR, Arregui-Dalmases, C, Luzon-Narro J. (In press) Biomecánica del impacto aplicada al accidente de tráfico. In Arregui-Dalmases, C, Luzon-Narro, J, Lopez-Valdes, F, del Pozo de Dios, E, Segui-Gomez, M (Ed.), Fundamentos de biomecánica en las lesiones por accidente de tráfico, Second Edition. Etrasa- Editorial Tráfico VialS.A.

E. Presentations and Invited Lectures:

- E1. “Occupant Kinematics in Laboratory Rollover Tests: PMHS Response” Stapp Car Crash Conference, San Diego, CA, November 2014.
- E2. “Occupant Kinematics and Shoulder Belt Retention in Far-Side Lateral and Oblique Collisions: a Parametric Study” Stapp Car Crash Conference, Kissimmee, FL, November 2013.
- E3. “Whole-Body Kinematics in Dynamic Rollover Tests: A Comparison of PMHS Responses for Leading-Side and Trailing-Side Front-Row Seating Positions” 41st International Workshop on Human Subjects for Biomechanical Research. Kissimmee, Florida, November, 2013.
- E4. “PMHS occupant kinematics during rollover”. National Highway Traffic Safety Administration, U.S. Department of Transportation, Washington D.C., September 2013.
- E5. “Occupant Spinal Motions during Vehicle Crashes: Implications on the Prediction of Injuries and the Design of Safety Countermeasures”. Japan Society of Automotive Engineers Impact Biomechanics Workshop. Tokyo, Japan, May 2012.
- E6. “A Methodology for Assessing Intrasegmental Kinematics of the Whole Human Spine During Impacts”. Japan Society of Automotive Engineers Annual Congress. Yokohama, Japan, May 2012.

- E7. “Identification of Anatomical Landmarks for Whole-Body Kinematic Measurement in the THOR Mod Kit Frontal Impact ATD”. Japan Society of Automotive Engineers Annual Congress. Yokohama, Japan, May 2012.
- E8. “Displacement Response of the Spine in Restrained PMHS During Frontal Impacts. Japan Society of Automotive Engineers”. Japan Society of Automotive Engineers Annual Congress. Yokohama, Japan, May 2012.
- E9. “PMHS Restraint and Support Surface Forces in Simulated Frontal Crashes”. Japan Society of Automotive Engineers Annual Congress. Yokohama, Japan, May 2012.
- E10. “In-situ Measurement of Occupant Motion During Motor Vehicle Collisions: Validity of Measures and Implications on the Prediction of Injuries”. University of Navarra School of Medicine. Pamplona, Spain, December 2011.
- E11. “Whole-Body Side-Impact Response”, European Center for Injury Prevention, University of Navarra, Pamplona, Spain, December 2010.
- E12. “Whole-Body Response to Pure Lateral Impact”, 54th Stapp Car Crash Conference, Scottsdale, Arizona, November, 2010.
- E13. “Experimental Methods for Measuring Motion”, University of Virginia School of Engineering and Applied Science, Charlottesville, VA, November 2009.
- E14. “Assessment and Validation of a Methodology for Measuring Anatomical Kinematics Under Impact Loading”, 37th International Workshop on Human Subjects for Biomechanical Research, Savannah, GA, November 2009.
- E15. “Thoracic Response Characterization for FE Model Development: Table-Top and Sled Test Conditions”, Chalmers University of Technology, Goteborg, Sweden, September 2009.
- E16. “PMHS Side Impact Response: Methods and Results”, Japan Automobile Research Institute, Tsukuba, Japan, July 2009.
- E17. “Internal vs. External Chest Deformation Response to Shoulder Belt Loading, Part 1: Table-Top Tests”, Society of Automotive Engineers World Congress, Detroit MI, April 2009.
- E18. “PMHS Frontal Sled Tests: Methods and Results”, Japan Automobile Research Institute, Tsukuba, Japan, July 2008.
- E19. “Kinematics of the Thorax under Dynamic Belt Loading Conditions” International Crashworthiness Conference, Kyoto Japan, July 2008.
- E20. “A Methodology for Analyzing Anatomical Kinematics Under Impact using High Speed 3D Motion Capture Technology”, National Highway Traffic Safety Administration, U.S.

Department of Transportation, Washington D.C., June 2008.

- E21. “Observed Cadaver Kinematics in Frontal Crash Tests Conducted at UVA”, presentation given to the Fairfax Inova CIREN Team, Fairfax, VA, May 2008.
- E22. “Kroell Corridors and Proposed Adjustments for Current Thoracic Force-Deformation Response Requirements”, National Highway Traffic Safety Administration, U.S. Department of Transportation, Washington D.C., October 2004.
- E23. “A Normalization Technique for Developing Corridors for Individual Subject Force-Deflection Responses”, Society of Automotive Engineers World Congress, Detroit, MI, March 2004.
- E24. “Assessment of the THOR and Hybrid III Crash Dummies: Steering Wheel Rim Impacts to the Upper Abdomen”, Society of Automotive Engineers World Congress, Detroit, MI, March 2004.
- E25. “THOR and Hybrid III ATD Responses to Anterior Loading, Cavanaugh-Type Tests”, National Highway Traffic Safety Administration, U.S. Department of Transportation, Washington D.C., February 2004
- E26. “A Normalization Technique for Developing Corridors for Individual Subject Force-Deflection Responses”, 31st International Workshop on Human Subjects for Biomechanical Research. San Diego, CA, October 2003.