

## Curriculum Vita: Dr. Brian J. Williams

### Contact Information:

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### Educational History

Ph.D., Statistics, The Ohio State University, 2000.

Dissertation: *Sequential Experimental Design for Computer Experiments*.

Dissertation advisors: Professors Thomas J. Santner and William I. Notz.

M.S., Statistics, The Ohio State University, 1996.

B.S., Applied Mathematics and Astronomy-Physics, University of Wisconsin-Madison, 1993.

### Professional Experience

- 7/08-      Scientist 4, Statistical Sciences Group, Los Alamos National Laboratory. Duties involve providing statistical support to uncertainty quantification efforts in several science and engineering applications.
- 9/03-7/08      Technical Staff Member, Statistical Sciences Group, Los Alamos National Laboratory. Duties involve providing statistical support to uncertainty quantification efforts in several science and engineering applications.
- 7/00-8/03      Associate Statistician, RAND Corporation, Santa Monica, CA. Duties involved providing statistical support to interdisciplinary projects and contributing to policy analysis.
- 6/99-9/99      Graduate Summer Intern, RAND Corporation, Santa Monica, CA. Duties involved application of statistical design and analysis of computer experiments methodology to aircraft survivability data. Supervisors: Dr. Bart Bennett and Dr. Lionel Galway.
- 1/97-5/97      Visiting Graduate Research Associate, Institut für Statistik, Ludwig-Maximilians-Universität, Munich, Germany. Supervisor: Professor Thomas Santner.
- 9/95-7/00      Graduate Research Associate, Department of Statistics, The Ohio State University. Duties involved statistical model development, data analysis and programming for interdisciplinary consulting projects. Supervisors: Professors Thomas J. Santner and William I. Notz.
- 9/93-8/95      Graduate Teaching Associate, Department of Statistics, The Ohio State University. Duties involved leading recitations and laboratory sessions for introductory statistics courses. Supervisors: Professors Angela M. Dean and William I. Notz.
- 7/92-6/93      Director of Academic Affairs, United Council of University of Wisconsin Student Governments. Duties included policy development, data analysis and serving on federal Department of Education committees.

5/90-5/93 Project Assistant, University of Wisconsin-Madison Space Astronomy Lab, Hubble Space Telescope High-Speed Photometer Project. Duties included database organization and scientific proposal development. Supervisor: Professor R. C. Bless.

### **Research Interests:**

Design and analysis of computer experiments; experimental design; statistical computing; spatial statistics; Bayesian inference.

### **Professional Societies:**

American Statistical Association, Institute of Mathematical Statistics, International Society for Bayesian Analysis.

### **Awards and Honors**

Distinguished Performance Award (2007), W88 MAR Physics Certification Team (21 recipients), Los Alamos National Laboratory, August 2008.

Distinguished Performance Award (2007), W76-1 Physics Certification Team (38 recipients), Los Alamos National Laboratory, August 2008.

DOE Award of Excellence (2007), Pit Lifetime Assessment Team (120 members), Los Alamos National Laboratory, December 2007.

Los Alamos Achievement Award (2007), Quantification of Margins and Uncertainties (QMU) Production Team, Los Alamos National Laboratory, September 2007.

Distinguished Performance Award (2004), Advanced Simulation and Computing (ASC) Primary Verification and Validation (V&V) Assessment Hydro Milestone Team (11 recipients), Los Alamos National Laboratory, July 2005.

The D. Ransom and Marian Whitney Award for Outstanding Consulting Effort as a Research Associate, Department of Statistics, The Ohio State University, 1998.

The Thomas E. and Jean D. Powers Award for Outstanding Lab Teaching Associate, Department of Statistics, The Ohio State University, 1994.

## **Publications**

### **Books Authored**

Santner, T.J., Williams, B.J., and Notz, W.I. (2003). *The Design and Analysis of Computer Experiments*. Springer, New York.

### **Refereed Articles**

Higdon, D., Gattiker, J., Williams, B. and Rightley, M. (2008). "Computer model calibration using high-dimensional output," *Journal of the American Statistical Association*, 103(482), 570-583.

- Higdon, D., Nakhleh, C., Gattiker, J. and Williams, B. (2008). “A Bayesian calibration approach to the thermal problem,” *Computer Methods in Applied Mechanics and Engineering*, 197, 2431-2441.
- Habib, S., Hietmann, K., Higdon, D., Nakhleh, C. and Williams, B. (2007). “Cosmic calibration: constraints from the matter power spectrum and the cosmic microwave background,” *Physical Review D*, 76(8), 083503 (17 pp.).
- Williams, B., Higdon, D., Gattiker, J., Moore, L., McKay, M. and Keller-McNulty, S. (2006). “Combining experimental data and computer simulations, with an application to flyer plate experiments,” *Bayesian Analysis*, 1(4), 765-792.
- Campbell, K., McKay, M.D. and Williams, B.J. (2006). “Sensitivity analysis when model outputs are functions,” *Reliability Engineering and System Safety*, 91, 1468-1472.
- Williams, B.J., and Huzurbazar, A.V. (2006). “Posterior Sampling with Constructed Likelihood Functions: An Application to Flowgraph Models,” *Applied Stochastic Models in Business and Industry*, 22(2), 127-137.
- Huzurbazar, A.V., and Williams, B.J. (2005). “Flowgraph Models for Complex Multistate System Reliability.” In *Modern Statistical and Mathematical Methods in Reliability*, Wilson, A.G., Limnios N., Keller-McNulty, S.A., and Armijo, Y.M. (eds). Singapore: World Scientific, pp. 247-262.
- Peltz, E., Colabella, L.P., Williams, B.J., and Boren, P. (2004). *The Effects of Equipment Age On Mission Critical Failure Rates: A Study of M1 Tanks*. RAND Publications.
- Chang, P., Williams, B.J., Bawa Bhalla, K., Belknap, T., Santner, T.J., Notz, W.I., and Bartel, D. (2001). “Design and analysis of robust total joint replacements: Finite element model experiments with environmental variables,” *Journal of Biomechanical Engineering*, 123, 239-246.
- Williams, B.J., Santner, T.J., and Notz, W.I. (2000). “Sequential design of computer experiments to minimize integrated response functions,” *Statistica Sinica*, 10, 1133-1152.
- Chang, P., Williams, B.J., Notz, W.I., Santner, T.J., and Bartel, D. (1999). “Robust optimization of total joint replacements incorporating environmental variables,” *Journal of Biomechanical Engineering*, 121, 304-310.
- Lenhoff, M., Santner, T.J., Otis, J., Peterson, M., Williams, B.J., and Backus, S. (1999). “Bootstrap prediction and confidence bands: a superior statistical method for analysis of gait data,” *Gait and Posture*, 9, 10-17 (1999).

**Other Writings: Technical Reports, Book Reviews, etc.**

- Loeppky, J.L., Moore, L.M., and Williams, B.J. (2008). “Batch Sequential Designs for Computer Experiments,” LA-UR-08-06310.
- Williams, B.J., Loeppky, J.L., Moore, L.M., Bingham, D.R., and Unal, C. (2008). “Towards a Predictive Maturity Model,” LA-UR-08-06309.

- Higdon, D.M., Anderson-Cook, C.M., Gattiker, J.R., Huzurbazar, A.V., Moore, L.M., Picard, R.R., Press, W.H., Williams, B.J., Wallstrom, T.C., Bornn, L.C., and Nelson, R.A. (2008). "QMU for Advanced Certification: Identifying Existing Limitations With Discussion of Solution Strategies," LA-UR-08-06308.
- Sigeti, D.E., Hemez, F.M., Lawrence, E.C., and Williams, B.J. (2008). "Statistical Studies of IET Simulations for the FY08 ASC Primary V&V Milestone (U)," LA-CP-08-01187.
- Maskaly, G.R., Williams, B.J., Fugate, M.L., Hanson, K.M., Wallstrom, T.C., Higdon, D.M., Chen, S.-R., Blumenthal, W., and Anderson, M.C. (2008). "Single Effects Tests (SETs) for High Explosives and PTW Parameters Studied in a Shavano Code (U)," LA-CP-08-01093.
- Loeppky, J.L., and Williams, B.J. (2008). "Discussion: The Design and Analysis of the Gaussian Process Model," LA-UR-08-06101. Submitted to *Quality and Reliability Engineering International*.
- Williams, B. and Higdon, D. (2007). "Integrating computer and physical experiment data," in *Encyclopedia of Statistics in Quality and Reliability*, Ruggeri, F., Kenett, R. and Faltin, F. W. (eds). John Wiley & Sons Ltd, Chichester, UK, pp. 854-861.
- Sigeti, D.E., and Williams, B.J. (2007). "GPM Statistical Parameter Studies for Exploration, Calibration, and Prediction (U)," submitted to 2007 NEDPC Proceedings.
- Williams, B.J., Thomas, V.A., and Higdon, D.M. (2007). "Simultaneous Calibration of a Diagnostic Signal From Multiple NTS Events (U)," LA-CP-07-1615.
- Chiravalle, V.P., and Williams, B.J. (2007). "A QMU Methodology for Weapon Assessment That Utilizes Underground Nuclear Test Data (U)," LA-CP-07-1577.
- Unal, C., Williams, B.J., Kandarian, R. and Sahota, M.S. (2007). "Sensitivities to Modeling Parameters in Uranium Fuels," LA-UR-07-6810.
- Unal, C., Williams, B.J., Kandarian, R., Korzekwa, D., Cummins, S. and Nelson, R. (2007). "Sensitivities to Initial/Boundary Conditions in Casting of Slender Uranium Rods," LA-UR-07-6594.
- Sterbenz, S.M., Sheehey, P.T., Carver, R., Chiravalle, V., Chitanvis, S., Ferm, E., Hollis, K., Hubbard, M., Janssen, R., McAninch, J., Prime, M.B., Sandoval, D., Unal, C., Williams, B., Young, J. and Wall, G.D. (2007). "Certification and Qualification Report for the W88/Mk5 Warhead with a Type 126 Pit Manufactured at Los Alamos, Volume II: Primary Physics (U)," X-4:2007-063(S).
- Nakhleh, C.W., Higdon, D., White, S.W., and Williams, B. (2007). "An Overview of the Implementation of the Quantification of Margins and Uncertainties Methodology at LANL (U)," LA-CP-07-1038.
- Parsons, D.K. and Williams, B.J. (2007). "Uncertainty and Sensitivity Analyses of Keelson Burn Calculations (U)," LA-CP-07-1026.
- Wallstrom, T.C., Fugate, M.L., Higdon, D.M., Unal, C. and Williams, B.J. (2007). "Assessing Uncertainty From Replicate Variation (U)," LA-CP-07-0877.

- Unal, C., Williams, B., Chiravalle, V., Sigeti, D., Lawrence, E., Kandarian, R. and Wall, G. (2007). "The Quantification of Margins and Uncertainties in W88 Pit Certification (U)," LA-CP-07-0667.
- Chiravalle, V.P., Unal, C., Williams, B., Hubbard, M. and Lawrence, E. (2007). "Sensitivity Studies in Support of the Certification Activities for Two Primaries (U)," LA-CP-07-0579.
- Fitzpatrick, J.A., Rogers, M.L., Williams, B.J., Belle, K.E., Simmons, K.H. and Guzik, J.A. (2007). "W76 UGT Radiochemical Response (U)," (LA-CP-07-0561), Proceedings of the Interagency Laboratory Working Group (ILWOG) 40.
- Unal, C., Williams, B., Higdon, D. and Nelson, R. (2006). "Towards Standardizing Uncertainty Estimations in Reactor Safety," (LA-UR-06-8642), Proceedings of the International Congress on Advances in Nuclear Power Plants (ICAPP) 2007, Paper 7082.
- Fugate, M., Williams, B.J., Higdon, D., Hanson, K. M., Gattiker, J., Chen, S.-R., and Unal, C. (2006). "Hierarchical Bayesian Analysis and the Preston-Tonks-Wallace Model," LA-UR-06-5205.
- Sigeti, D.E. and Williams, B.J. (2006). "A Comparison of a Statistical Study and a Traditional Parameter Study in Primary Burn Simulations (U)," LA-CP-06-1041.
- Higdon, D., Williams, B., Gattiker, J. and Thomas, V. (2006). "Combining Simulations and Experiments for QMU-based Certification for a B61 Primary (U)," LA-CP-06-1033.
- Sigeti, D.E. and Williams, B.J. (2006). "Uncertainty Quantification for Primary Burn Simulation (U)," LA-CP-06-1021.
- Williams, B., Kao, J., Hubbard, M. and Higdon, D. (2006). "Uncertainty Quantification of W88 Primaries (U)," LA-CP-06-1000.
- Kao, C.-Y. J., Hubbard, P. and Williams, B. (2006). "Development of Komodo Baseline and Uncertainty Quantification (U)," (LA-CP-06-0009), Proceedings of the 2005 Nuclear Explosives Design Physics Conference.
- Williams, B.J., and Higdon, D. (2005). "Overview of Statistical Methodology for Integrating Information from Simulation Models and Experimental Data," LA-UR-05-4952.
- Unal, C., Wall, G., Trent, B., Sandoval, D., Williams, B.J., and Kandarian, R. (2005). "W76-0 Primary Manufacturing Uncertainties and their Effect on Performance (U)," LA-CP-05-1087.
- Moore, L.M., Higdon, D.M., Gattiker, J.R., Williams, B.J., Thomas, V.A., and Kandarian, R. (2005). "Statistical Tools for Primary Certification and Uncertainty Quantification With Applications (U)," LA-CP-05-1072.
- Unal, C., Gattiker, J., Higdon, D., Williams, B.J., and Kandarian, R. (2005). "Preliminary Analysis of Uncertainty in Implosion Models Predicting the 3596 Hydro Test (U)," LA-CP-05-1067.
- Higdon, D.M., Gattiker, J.R., and Williams, B.J. (2005). "Parameter Calibration Using Multiple Types of Experiments (U)," LA-CP-05-0817.
- Nelson, R., Higdon, D., Williams, B.J., and Sharp, G. (2005). "Hydro Validation of a Shavano Project Code Using Pinshot 3554 and Core Punch 3519 (U)," LA-CP-05-0634.

- Sharp, G., Keinigs, R., Canfield, T., Kandarian, R., Boettger, J., Rightley, M., Higdon, D., Williams, B.J., Moore, L., Collins, J. and Nelson, R. (2005). “Preliminary Shavano Project Code Validation and Verification; Section 1: Small Effects Tests (SET) (U),” LA-CP-05-0598.
- White, S., Williams, B.J., Higdon, D., Moore, L. and McKay, M. (2005). “Sensitivity Study for Q2FY05 Primary V&V Milestone (U),” LA-CP-05-0567.
- Peltz, E., Colabella, L.P., Williams, B.J., and Boren, P. (2004). “The Effect of Age on the M1 Tank: Implications for Readiness, Workload, and Recapitalization,” Research Brief, RAND Publications.
- Williams, B.J. (2004). Book review of *Visualizing Statistical Models and Concepts*, Journal of the American Statistical Association, 99, 292.
- Campbell, K., Moore, L.M., McKay, M.D., Thomas, V.A., and Williams, B.J. (2004). “Sensitivity Studies Applied to Boost (U),” (LA-CP-04-0865), Proceedings of the 2004 Nuclear Explosives Code Designer Conference.
- Williams, B.J. (2003). “Sequential Experimental Design of Computer Experiments,” LA-UR-03-8078.
- Kirby, S., Fricker, R., and Williams, B.J. (2001). “Manning the Army Special Operations Forces: an interim progress report,” RAND AB-502, not cleared for open publication.

### **Works in Progress**

- Huzurbazar, A.V., and Williams, B.J. “Incorporating covariates in flowgraph models: Applications to recurrent event data,” *Technometrics*, under review.
- Williams, B.J., Loepky, J.L., Moore, L.M., Bingham, D.R., and Unal, C. “Towards a predictive maturity model.”
- Williams, B., Morris, M., and Santner, T.J. “Using multiple computer models and multiple data sources simultaneously to infer calibration parameters.”
- Loepky, J.L., Moore, L.M., and Williams, B.J. “Batch sequential designs for computer experiments.”
- Williams, B.J., Santner, T.J., and Notz, W.I. “Sequential design of computer experiments with multiple responses for constrained optimization.”
- Lu, W., Ranjan, P., Bingham, D., Reese, S., and Williams, B. “Follow-up experiment designs for computer models and physical processes.”
- Ranjan, P., Bingham, D.R., and Williams, B.J. “Expected improvement criteria for estimating pre-specified features of expensive computer models.”

### **Invited Presentations**

- “Using Multiple Computer Models and Multiple Data Sources Simultaneously to Infer Calibration Parameters” (LA-UR-08-5257) presented at:
- Joint Statistical Meetings, Denver, CO, August 2008.
  - RAND, Santa Monica, CA, August 2008.

- “Proof-of-Concept Application of UQ to Material Modeling” (LA-UR-08-4735), Verification and Validation for Nuclear Systems Analysis Workshop, Idaho Falls, ID, July 2008.
- “Calibrating a Computer Code in the Presence of Systematic Discrepancy” (LA-UR-08-3895), Quality and Productivity Research Conference, Madison, WI, June 2008.
- “On Combining Functional Experimental Data and Computer Simulations” (LA-UR-07-7687) presented at:
- INFORMS Annual Meeting, Seattle, WA, November 2007.
  - The Boeing Company, Seattle, WA, November 2007.
- “Towards Standardizing Uncertainty Estimations in Reactor Safety” (LA-UR-06-8642), American Nuclear Society (ANS) Annual Meeting, Boston, MA, June 2007.
- Short course on “Design and Analysis of Complex Computer Models” (LA-UR-07-1994), Pratt & Whitney, Hartford, CT, March 2007.
- “UQ for Weapons Calculations: Applications to W76 LEP (U)” (LA-CP-07-0258), Joint Working Group (JOWOG) 32S, Workshop on Quantification of Margins and Uncertainties, LANL, March 2007.
- “UQ for Weapons Calculations: Application to W76 LEP (U)” (LA-CP-07-0136), ASC Principal Investigator’s Meeting, Las Vegas, NV, February 2007.
- “Uncertainty Quantification for Weapons Simulations Using a Bayesian Approach (U)” (LA-CP-07-0037), ASC V&V Workshop, Los Alamos, NM, January 2007.
- “Uncertainty Quantification With Data Constraints Using a Bayesian Approach: Applications in the Weapons Program (U)” (LA-CP-06-1277), Predictive Science Panel, Los Alamos, NM, November 2006.
- “Combining Functional Experimental Data and Computer Simulations: An Application to Fluid Instability Modeling” (LA-UR-06-5384) presented at:
- Joint Statistical Meetings, Seattle, WA, August 2006.
  - Theory, Simulation and Computation Directorate Capability Workshop: Advanced Methods in Data Analysis, LANL, September 2006.
- “GPM/SA Code Operation” (LA-UR-06-5431), SAMSI Summer School on the Design and Analysis of Computer Experiments, Vancouver, BC, CA, August 2006.
- “Constrained Optimization of Computer Experiments Using an Expected Improvement Criterion” (LA-UR-06-7797), INFORMS Annual Meeting, Pittsburgh, PA, November 2006.
- “Uncertainty Quantification for Functional Data: Application to Lineouts From Radiographic Images,” L2 Milestone Review, LANL, September 2006.
- Short course on “Bayesian Modeling and Calibration of Computer Models,” LANL, December 2006.
- “Uncertainty Quantification for Combining Experimental Data and Computer Simulations,” presented at:
- Naval Postgraduate School, November 2005.
  - Design and Analysis of Experiments 2005 Conference, October 2005.
  - D-Division (LANL) Review Committee, March 2005.

- “Uncertainty Quantification and Calibration of Preston-Tonks-Wallace (PTW) Model Parameters,” ASC Primary V&V Assessment Milestone Review, June 2005.
- “Introduction to Statistical Modeling of Simulation Experiments,” Procter and Gamble, October 2004.
- “Sequential Experimental Design of Computer Experiments,” presented at:
- 3rd JANNAF Modeling and Simulation Subcommittee (MSS) Meeting, Colorado Springs, CO, December 2003.
  - Los Alamos National Laboratory, February 24, 2003.
  - Fourth International Conference on Operations and Quantitative Management, January 3, 2003.
- “Sequential design of computer experiments with multiple responses for constrained optimization,” Quality, Statistics, and Reliability Section, INFORMS Annual Meeting, November 4, 2001.
- “Sequential design of computer experiments for optimization of integrated response functions,” The University of New Mexico, April 27, 2001.
- “Sequential optimization of computer experiments for competing integrated response functions,” First Midwest Conference for New Directions in Experimental Design, May 19, 2000.
- “Sequential design of computer experiments” presented to:
- The Ohio State University Statistics Department 25th Anniversary Conference, October 7, 1999.
  - U.S. Census Bureau, June 3, 1999.
- “Improving aircraft survivability analysis using statistical methods,” RAND, September 29, 1999.
- “Design and analysis of computer experiments,” Cornell University, June 10, 1998.

### **Sessions Organized at National Meetings**

- “Computer Experiments,” Design and Analysis of Experiments 2005 Conference, October 2005.

### **Contributed Presentations**

- “Uncertainty Quantification With Data Constraints Using a Bayesian Approach (U)” (LA-CP-06-1102), Nuclear Explosives Code Designer Conference, Los Alamos, NM, October 2006.
- “Using Sensitivity Analysis to Support Robust Adaptive Planning,” Probabilistic Safety Assessment and Management Conference, San Juan, Puerto Rico, June 25, 2002.
- “Sequential Experimental Design of Computer Experiments for Optimizing Integrated Response Functions,” Joint Statistical Meetings, Atlanta, GA, August 9, 2001.

### **Refereed Abstracts and Posters**

“Optimization of a flexible hip implant incorporating in-vivo variations in joint force and bone properties,” P.B. Chang, B.J. Williams, T.J. Santner and D.L. Bartel, presented at the Orthopedic Research Society Meeting, 1998.

“The mathematical modeling of process variables in the control of the physical properties of ultra high molecular weight polyethylene,” L.C. Duus, B.J. Williams, S. Li and T.J. Santner, poster session, Orthopedic Research Society Meeting, 1997.

### **Current Research Projects:**

**Advanced Certification.** Project leader: Donald Haynes, LANL (X-4). Compile a white paper on the relevant statistical considerations for supporting weapon system certification. Topics include: QMU review, uncertainty quantification (UQ) concepts for future certification efforts, certification metrics and associated thresholds, failure modes, reliability, and approaches for identifying near-neighbor clusters of full-system tests for UQ analyses.

**Verification and Validation of Codes for the Global Nuclear Energy Partnership (GNEP) Program.** Project leader: Cetin Unal, LANL (X-4). Perform sensitivity studies with physics codes proposed for supporting nuclear fuels development. Applications include a uranium casting process and conduction heat transfer from uranium rods to sodium coolant. Calibrate codes to experimental data and develop methods for recommending future experiments based on assessments of available codes and data.

**Verification, Validation and Certification for LANL Weapons Systems.** Project leaders: David Higdon, LANL (CCS-6); Mark Anderson, LANL (X-3). Application of statistical calibration and prediction methodology for integrating computer models and experimental data to annual assessments of the W76 and W88 weapon systems. Integration of manufacturing variability and physics parameter uncertainty into a comprehensive approach to weapon reliability assessments. Validation of radiography calculations and relationships to fully integral performance metrics. Uncertainty quantification of full system weapon calculations for inclusion in future weapon system certification plans.

### **Prior Research Projects:**

**W76 Life Extension Program and W88 Manufacturing Assembly Release Certification.** Project leader: Cetin Unal, LANL (X-4). Integrate several sources of experimental data (e.g. small scale experiments, pinshots, core punches, and Nevada Test Site diagnostics) into a unified framework for calibrating uncertain physics parameters in computer models. Assessment of performance metrics with uncertainty quantification for annual system certification.

**Methodology and Tool Development.** Project leader: Charles Nakhleh, LANL (X-2). Development, performance assessment and application of statistical calibration and prediction methodology for integrating computer models and experimental data.

Contribute functionality to experimental design and statistical analysis tools (e.g. implementation of symmetric Latin hypercube design with columnwise–pairwise and simulated annealing optimization, and global sensitivity analysis methods).

**ASC Primary and Secondary V&V Assessment.** Project leaders: Ralph Nelson (X-4) and Kimberly New (X-2), LANL. Analysis of simulation and experimental data from small scale and integrated effects tests to support primary and secondary ASC code validation efforts.

**Procter and Gamble Baby Care.** Project leader: Art Koehler, P&G. Collaborate with P&G analysts on design and analysis of simulation and physical experiments to study properties of materials used in diaper products.

**Alternatives for Achieving Aircraft Survivability.** Project leaders: Bart Bennett and Jeff Hagen, RAND. Implement statistical techniques for facilitating analysis of engagement and mission level aircraft survivability data. Execute mission level simulation model for scenario under current study.

**Implementing Uncertainty Management.** Project leader: Robert Lempert, RAND. Design a study of statistical experimental design and prediction techniques for analysis of output from a climate change computer model. Implement statistical techniques for input sensitivity analysis and output prediction and optimization.

**Mission Reliability.** Project leader: Eric Peltz, RAND. Develop and implement statistical models for analyzing factors contributing to tank and other Army ground system mission critical failures. Apply this model to estimating failure rates based on intrinsic system properties and activity.

**Alcohol Outlets, Broken Windows, Gonorrhea and HIV Risk.** Project leader: Deborah Cohen, RAND. Examine the influence of alcohol outlets and deteriorated neighborhoods on the rates of gonorrhea and HIV. Implement spatial and temporal methods for the analysis of longitudinal data on gonorrhea rates and neighborhood conditions in Los Angeles county.

**Patient-Centered Care and Myocardial Infarction Outcomes.** Project leader: Allen Fremont, RAND. Examine whether patients' experiences with patient-centered aspects of care predict cardiac events and mortality up to four years post-acute myocardial infarction. Assess whether such experiences affect subsequent utilization of cardiovascular hospital care and procedures.

**Evaluation of the National Flood Insurance Program: NFIP Market Penetration.** Project leader: Lloyd Dixon, RAND. Determine the appropriate market penetration rate of flood insurance given both the benefits and costs of higher penetration. Examine how conclusions about market penetration rates vary as a function of weights placed on different NFIP programmatic goals.

**Manning Army Special Operations Forces.** Project leader: Sheila Kirby and Margaret Harrell, RAND. Assemble database of active and reserve component Special

Operations Forces enlisted and officer personnel. Assess personnel staffing, recruitment and retention issues with these data.

**Analysis of Engagement Level Aircraft Survivability Data.** Supervisor: Dr. Bart Bennett, RAND. Applied concepts from the design and analysis of computer experiments to engagement level aircraft survivability data. Determined that simulation sizes for certain classes of problems can be reduced substantially by accounting for the spatial structure of the data.

**Performance Optimization of Total Hip Replacement Devices.** Supervisors: Professors Thomas Santner and William Notz, The Ohio State University; Professor Donald Bartel, Cornell University. Introduced statistical techniques of experimental design and analysis of data from computer experiments to the biomechanical literature on performance optimization for total hip replacement devices. Determined geometrical parameters of proposed flexible implant that maximized device lifetime for most patients.

**Analysis of Gait Data.** Supervisor: Professor Thomas Santner, The Ohio State University. Examined the operating characteristics of two approaches for deriving confidence and prediction bands for gait analysis data. Concluded that the standard approach performed poorly and recommended an alternate procedure based on the bootstrap for reaching conclusions in gait studies.

### Professional Service

Referee for Journals: *Journal of the American Statistical Association*, *Technometrics*, *Journal of the Royal Statistical Society Series B*, *Journal of Computational and Graphical Statistics*, *Operations Research*, *Naval Research Logistics*, *RAND Publications*.

### References

- Dr. David Higdon  
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