Caleb S. Davis, Ph.D.

Senior Consulting Statistician and Mechanical Engineer

Dr. Cal Davis consults in the areas of STATISTICAL INFERENCE and its applications to automotive safety issues and DATA ANALYSIS, especially as applied to automotive safety issues. His engineering and statistical experience has extended to the automotive, nuclear power, aeronautic, railroad, bio-mechanical, and building industries and has involved problems in fracture mechanics, inspection reliability, epidemiology, mechanical engineering, automated design, and safety risk assessment. In his 20-plus years of aeronautic applications, Dr. Davis specialized in analysis of FATIGUE, FRACTURE, and CRACK GROWTH LIFE and RELIABILITY PREDICTION, including numerical methods for automated design.

For JP Research, Dr. Davis has developed techniques to extend registration data, assemble occupancy and exposure data, automate risk analysis, and set up SIGNIFICANCE TESTS and CONFIDENCE BOUNDS for accident risk. He has performed advanced statistical analyses for numerous JP Research studies using and extending NHTSA (FARS, SCI, NASS, GES) data, state accident data files, and R.L. Polk registration data. Other activities over past two decades include development of various special purpose Visual Basic for Applications programs (such as categorized data analysis and data analysis quality control) and consultation on acquisition and interpretation of data. Analyses of generalized linear models have included LINEAR and LOGISTIC REGRESSION, SURVIVAL ANALYSIS, MANTEL-HAENSZEL METHOD, EXACT TESTS and CONFIDENCE LIMITS, and OPTIMALITY CRITERIA for experiment design. He is also experienced in estimation for nonlinear models and structural equations.

Education and Professional Honors

University of California, Los Angeles	Ph.D., Engineering	1976
University of California, Los Angeles	M.S., Solid Mechanics	1963
Lehigh University	B.S., Civil Engineering	1955

Pi Mu Epsilon (Mathematics Honorary Society), University of California, Los Angeles

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Professional Experience

JP Research, Inc., Mountain View, California
Senior Engineering Consultant, 1998-Present
Private consulting activities cover areas of statistical inference and data analysis applied to automotive safety issues. These include development of specialized data analysis programs and consultation on data acquisition and interpretation. Has performed advanced statistical analyses for numerous automotive safety-related JP Research studies using and extending NHTSA, state (police-reported) accident, and R.L. Polk registration data. Developed techniques to extend registration data, assemble occupancy and exposure data, automate risk analysis, and set up significance tests and confidence bounds for accident risk.

Consulting Engineer, Los Altos, California
Consultant, Self-Employed, 1991-Present
Private statistical and data analysis consulting practice. Primary clients include JP Research (see above) and Exponent [formerly Failure Analysis] (see below).

Failure Analysis Associates, Menlo Park, California
Senior Engineer, 1977-1991
Solving statistical problems involving fracture mechanics, inspection reliability, epidemiology, and safety risk assessment for the automotive, nuclear power, railroad, bio-mechanical, and building industries. Developed theory and code for data reduction and statistical analyses on mainframe and personal computers. Testified as expert witness in federal courts on automotive safety. [For details, see selected publications]

University of New Orleans, New Orleans, Louisiana
Assistant Professor, 1976-1977
Taught graduate and undergraduate courses in mechanical engineering. Continued with Martin-Marietta as a consultant on fracture. Developed theory for one-dimensional (published 1980).

Martin-Marietta Company, Michoud facility**,** New Orleans, Louisiana
Fracture Engineer, 1975-1976
Developed proof test criteria for space shuttle LH2 and LO2 tanks.

Lockheed-California Company, Burbank, California
Structures Engineer, 1955-1974
Developed fatigue tests for airframes and helicopter parts including flight data analysis, loads definition, and interpretation of results. Studied effects of machining, shot peening, and plating on fatigue of parts.

Selected Programs, Publications and Presentations

Selected Programs

"Generalized Linear Models regression for linear, log-linear, and logistic models, and with Peto-Breslow and Prentice-Gloeckler methods for proportional hazards models" (November 1997). Output displays eigenvector, delta beta, and deletion deviance residuals among residuals computed as well as the usual statistics. Proportional hazards analyses can treat time-dependent variables and use one variable to stratify data.

"Automated Design with Integrally Stiffened Panels against Crack Growth and Fracture" (August 1996). For numerically intensive minimization and design constraint routines. AutoCAD drawing displays panel designs. Design progress is charted real time and a summary report of structural integrity is provided.

"Mantel-Haenszel Analysis of Multiple 2x2 Tables" (1984 with Don Horst; revised 1990). GW Basic for PC program prepared at Failure Analysis Associates (Exponent). In 2001, the software was updated in Visual Basic to include confidence bounds; exact tests and exact confidence bounds are included with exterior, interior, and midpoint options. User manual.

Selected Publications

"The Impact of the 1968 Evaporative Loss Standard on Automotive Fire Risk," Engineering Applications of Risk Analysis 2: ASME Winter 1989 Annual Meeting, San Francisco, p1-8, (January 1990) (with G.E. McCarthy, R.C. Lange, and R.L. McCarthy).

"Gasoline Fires at Service Stations: Safety Benefits of Stage 2 Refueling Vapor Recovery Systems," Engineering Applications of Risk Analysis 2: ASME Winter 1989 Annual Meeting, San Francisco, p9-16, (January 1990) (with G.E. McCarthy, R.L. McCarthy, and R.C. Lange).

"Railroad Tank Car Safety Assessment," FaAA PA-R 89-12-05, prepared for Association of American Railroads Technical Center, (December 1, 1989) (with Graeme Fowler).

"An Evaluation of the NTSB Report Entitled: 'Safety Study-- Performance of Lap Belts in 26 Frontal Crashes' NTSB/SS-86/03," FaAA PA-R 89-08-10, (July 1, 1987) (with R.L. McCarthy and J. Padmanaban). This became a GAO report.

“A Review of Fracture Mechanics Life Technology,” NASA Tech Brief, (1984) (with Phil Besuner, Dave Harris, et al). Received Certificate of Recognition from NASA, June 15, 1984.

"Review of Finnair Employment Data for Comparison of Discharge Rates Related to Certain Allegations of Discrimination," FaAA PA-R 84-01-06, (January 1, 1984).

"A Risk Analysis of Unattended Vehicle Movement," FaAA PA-R 83-07-08, prepared for U.S. Dept. of Transportation, (August 1983) (with R.L. McCarthy, R.C. Lange and J. Padmanaban).

“An Engineering and Probabilistic Analysis of Tube Cracking Performance in Once-Through Steam Generators,” EPRI Technical Report NP-3065, (July 1983) (with J.M. Thomas, S.W. Winder, and D.E. Allison).

“Reliability Study of Automatic and Manual Restraint Systems,” FAA-82-2-14, prepared for U.S. Dept. of Transportation, NHTSA, (March 1982) (with R.L. McCarthy, G.W. Rogers, and A. Curzon).

“A Synthesis of Failure Prevention and Reliability Methods,” Failure Prevention and Reliability – 1981, (Francis T.C. Loo, Ed.), The American Society of Mechanical Engineers, New York, p157-166, (1981) (with J.M. Thomas).

"A Statistical Analysis of the NHTSA 107 Fleets Search," FaAA PA-R 81-09-01, (September 1981) (with R.L. McCarthy and S. Brown).

“Correlation of Millstone Finite Element Models with Tube Profilometer Measurements,” FAA-81-3-12, (September 1981) (with S.A. Rau and J.M. Thomas).

“Line Search Methods for Extended Penalty Function Environments,” International Journal for Numerical Methods in Engineering, v15, p867-888, (1980).

“Methodology Review and Data Requirements: Task II of Failure Cause Analysis for Turbine Bearing Systems,” FAA-79-12-2, prepared for Franklin Research Technical Center [under contract to EPRI], (December 20, 1979) (with J.M. Thomas, R.L. McCarthy, P.M. Besuner and G.W. Rogers).

"Strategy for Models of Tube Cracking in Once Through Steam Generators," FaAA PA-R 79-05-01(F), prepared for Electric Power Research Institute, Palo Alto, CA, (November 1, 1979) (with J.M. Thomas and R.C. Cipolla).

“Cost-Effective Strategies for Rail Use and Inspection,” Association of American Railroads Conference on Track-Train Dynamics, Preconference Proceedings, Chicago, Illinois, (November 1979) (with J.M. Thomas and P.R. Bosinoff).

"Estimation of the Defect Detection Probability for Ultrasonic Tests on Thick Section Steel Weldments," EPRI Technical Report NP-991 (February 1979) (with D.P. Johnson and T.L. Toomay).

"Inspection Impact on Flaw Growth and Fracture Reliability for Power Plant Components," FAA-EPRI-79-3-1, (February 1979) (with J.M. Thomas).

"Strategy and Methods for Cost-Risk Analysis of Defective Rail," FAA-78-12-1, prepared for the Association of American Railroads and the Federal Railroad Administration, (December 1978) (with J.M. Thomas, T.W. Rettig and P.R. Bosinoff).

"Evaluation of the Performance and Design of Zimmer T 28 Prostheses Used for Total Hip Replacement," FAA-78-06-7, (June 1978) (with G.R. Egan and D.O. Cox).

"Automated Design of Stiffened Panels Against Crack Growth and Fracture Among Other Design Constraints," Flaw Growth and Fracture, ASTM STP 631, p416-445, (1977).