CURRICULUM VITAE OF BRYAN RUSSELL BECKER, Ph.D., P.E.

(8 July 2002)

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CURRICULUM VITAE

BRYAN RUSSELL BECKER, Ph.D., P.E.

BACKGROUND INFORMATION

Date of Birth: August 6, 1948 **Place of Birth:** St. Louis, MO

Citizenship: United States **Marital Status:** Married, 3 Children

Business Address:
University of Missouri – Kansas City
Mechanical Engineering
350C Robert H. Flarsheim Hall
5100 Rockhill Road
Kansas City, MO 64110-2499

Home Address:
22705 NW Ashford Court
Blue Springs, MO 64015-7333

Business Telephone: (816) 235-1255 **Home Telephone:** (816) 224-2807
Business FAX: (816) 235-1260 **E-Mail:** beckerb@umkc.edu

Academic Rank: Professor of Mechanical Engineering
Adjunct Professor of Nuclear Engineering

Education: Ph.D., Engineering Science, 1979, University of Tennessee, Knoxville
M.S., Applied Mathematics, 1975, University of Missouri, Columbia
B.S., Mechanical Engineering, 1971, University of Missouri, Rolla

Professional Engineer Registration: Missouri (E-25766)
Kansas (12666)
Indiana (PE60870134)

Area of Expertise: Numerical analysis of heat transfer and fluid flow phenomena pertaining to energy systems utilizing both finite element and finite difference techniques; modeling of food refrigeration; fluid dynamics; heat transfer; thermodynamics; turbulence; atmospheric science; utilization of fly ash as a construction material.

Academic Experience

9/72 - 8/73: Instructor, Community Education Center, Rochester School District, Rochester, New York.
9/73 - 5/75: Graduate Teaching Assistant, Mathematics Department, University of Missouri, Columbia.
9/82 - 6/83: Visiting Professor, Department of Mechanical and Aerospace Engineering, University of Tennessee, Knoxville.
10/85 - 8/87: Associate Professor, Department of Mechanical Engineering, Rose-Hulman Institute of Technology, Terre Haute, Indiana.
9/87 - 8/93: Assistant Professor, Department of Mechanical and Aerospace Engineering, University of Missouri, UMC/UMKC Coordinated Engineering Program, Kansas City.
9/93 - 8/99: Associate Professor, Department of Mechanical and Aerospace Engineering, University of Missouri, UMC/UMKC Coordinated Engineering Program, Kansas City.
5/97 - 6/01: Associate Chair, Department of Mechanical and Aerospace Engineering, University of Missouri, UMC/UMKC Coordinated Engineering Program, Kansas City.

9/99 - 6/01: Professor, Department of Mechanical and Aerospace Engineering, University of Missouri, UMC/UMKC Coordinated Engineering Program, Kansas City.
7/01-Present: Professor, Mechanical Engineering, University of Missouri, Kansas City.
7/01-Present: Head, Engineering Sciences Division, University of Missouri, Kansas City.
2/02-Present: Adjunct Professor, Nuclear Science and Engineering Institute, University of Missouri, Columbia.

Industrial Experience

9/67 - 5/68: Co-op Student, McDonnell Douglas Corporation, St. Louis, Missouri.
9/69 - 6/71: Co-op Student, Xerox Corporation, Rochester, New York.
3/72 - 9/72: Associate Engineer, Product Development Division, Xerox Data Systems, Xerox Corporation, Rochester, New York.
6/75 - 10/85: Computing Applications Analyst, Heat Transfer and Fluid Flow Section, Computer Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.
5/87-Present: Director of Engineering and Principal, Becker Engineering Company, Blue Springs, Missouri.

Consulting

1986: • Quaker Computer Solutions
1990: • Henri J. Watson, Attorney at Law
1991 - 1992: • Policy Research Associates
1992: • Black & Veatch
1992 - 1994: • Waste Policy Institute
1992 - 1994: • Tekspectrum
1993 - 1994: • Thomas J. Lipton Company
1993 - 1994: • International Copper Association
1994: • Field, Gentry & Benjamin, P.C.
• Marley Cooling Tower Company
1994 - 1995: • Burns & McDonnell
1994 - 1995: • Puritan Bennett Aero Systems
1996: • Thomas J. Lipton Company
1994 - 1997: • Nathan C. Harbur, Attorney at Law
1996 - 1997: • Yeretsky & Maher, L.L.C.
1997: • Ruskin Manufacturing Company
• John J. Marek, Attorney at Law
1997 - 2001: • Shook, Hardy & Bacon, L.L.P.
2000: • Labconco Corporation
2001: • Quaker Oats Company
2002: • Ruskin Manufacturing Company
• Unilever Best Foods – North America

U.S. Department of Energy Proposal Review Panels

- Office of Technology Development, Program Research and Development Announcement #DE-RA21-92MC28245: Environmental Restoration and Waste Management Technologies; January 12-17, 1992, Morgantown Energy Technology Center, Morgantown, WV (42-person panel awarded **$45 million**).
- Office of Technology Development, RFP #94-RM-92: Integrated Demonstration, Plutonium in Soils; August 23-28, 1992, Nevada Test Site, Las Vegas, NV (6-person panel awarded **$4 million**).
- Strategic Environmental Research and Development Program: Applied Research/Technology Demonstration/Technology Transfer; November 19-24, 1993 (reviewed 11 proposals; SERDP budget: **$169 million**).

Electric Power Research Institute Workshops, for Planning of EPRI'S Research Agenda

- Residential Desuperheaters, July 18-19, 1991, Atlanta, GA (26 participants).
- Working Fluids for Unitary Air Conditioners and Heat Pumps, March 24-26, 1992, Dallas, TX (31 participants).
- Energy Efficient Office Technologies, June 17-18, 1992, San Jose, CA (73 participants).
- Working Fluids for Positive Displacement Chillers, July 1-3, 1992, Baltimore, MD (29 participants).

U.S. Air Force Research Fellowships

- Summer Research Fellow, Aero Propulsion Laboratory, Dayton, Ohio, 5/18/87 - 8/14/87.
- Summer Research Fellow, Aero Propulsion Laboratory, Dayton, Ohio, 5/16/88 - 8/12/88.

Honors

- University of Missouri, College of Engineering Research Fellow, 1/1/93 - 12/31/94.
- ASME Faculty Advisor Award, CEP ASME Student Section, 4/12/96.
- Listed in Who's Who in Science and Engineering, 3rd Edition, 1996-1997.
- University of Missouri, College of Engineering CEP Research Award, 1998.
- ASME Region 7 Faculty Advisor Award, 1998.
- ASHRAE Distinguished Service Award, 1999.
- ASME Fellow, 2000.

Professional Development

- Industrial Refrigeration Workshop, sponsored by Kansas State University and the International Institute of Ammonia Refrigeration, August 2-6, 1993, Manhattan, Kansas.
- Freezing Technology for the Frozen Food Industry, sponsored by the University of California-Davis, Department of Food Science and Technology, April 27-29, 1998, Davis, California.
- Model-Based Engineering, Design, Manufacturing and Certification of DOE/NNSA NWC Products, sponsored by Honeywell Federal Manufacturing & Technologies, August 28-30, 2001, Kansas City, Missouri.
- University of Missouri Leadership Development Program, September 2001 – July 2002, sponsored by the University of Missouri System.
- University of Missouri Leadership Development Workshop, sponsored by the University of Missouri System, October 1-4, 2001, Lake Ozark, Missouri.
- Meeting Air Quality Standards, sponsored by Kansas Gas Service, March 19, 2002, Kansas City, Missouri.
- Leading During Change, sponsored by the University of Missouri System, April 22, 2002, Columbia, Missouri.

TEACHING ACTIVITIES

Theses Directed

Doctor of Philosophy:

1. B.A. Fricke, "Computer Algorithms for Calculating the Cooling and Freezing Times, Refrigeration Loads and Thermal Properties of Foods and Beverages," Fall 1998.
2. M.S. Abu-Saymeh, "Optimal Low-Thrust Interplanetary Missions," In progress.
3. R.E. Pearce, "Development of Condenser Models," In progress.

Master of Science:

1. B.D. Chen, "Computation of Air Flow Rate and Pressure Distribution in a Cooling Tower with Anisotropic Fills Using the Finite Element Method," May 1987.
2. J.W. Wilkus, "Measuring the Accuracy of a Torque System that Tightens Bolts to Yield," Fall 1989.
3. R.W. Gelven, "Quality Improvements Through Design of Experiments," Winter 1990.
4. L.F. Burdick, "Optimization of Cooling Tower Drift Eliminator Design," Winter 1991.
5. J.P. Hays, "Development and Analysis of an Empirical Model of Industrial Process Fouling," Summer 1994.
6. B.A. Fricke, "A Computer Algorithm for Determining Moisture Loss and Latent Heat Load in the Bulk Storage of Fruits and Vegetables," Fall 1994.
7. R.F. Schmitt, "A Methodology for Cost Benefit Analysis of Ice Storage Systems for Commercial Applications," Winter 1996.
8. R.E. Pearce, "Life Management of Feedwater Heaters at Kansas City Power and Light," Winter 1996.
9. J.R. Crawford, "Comprehensive HVAC Design for a Ground Based Radar Facility in a Marine Environment," Summer 1996.
10. Z. Wang, "Study of Modeling Rough Rice Drying," Fall 1997.
11. R. Fosalau, "Miller Steam Plant Operations," Fall 1997.
12. B.M. Holland, "Optical Pyrometer Monitoring of Combustion Turbine Blades," Winter 1998.
13. G.L. Schuttler, "An Analysis and Evaluation of an Angled Piston Ring Concept," Winter 1998.
14. P.L. Boeschen, "A Case Study of Condensing Boiler Energy Savings," Fall 1998.
15. J.L. Parsons, "Dual Register Burner Adjustment Strategy," Fall 1999.
16. T.J. Fogarty, "Process and Design Improvements for a Chemical Oxygen Generator," Fall 1999.
17. G.P. Hentschel, "Simplified Plume Model for Cooling Towers," Winter 2000.
18. B.S. Kessler, "Failure Analysis of Rolling Element Bearing Components," Summer 2000.
19. M.A. Nazzal, "Assembly Planning for String-Like Parts," Winter 2001.
20. M.J. Mastio, Jr., "Barrel Material Selection for Twin Screw Extrusion of Breakfast Cereal," Winter 2002.
21. P.S. Dhaliwal, "Analysis of Insulated Panels," In progress.
22. P.S.K. Mylavarapu, "Optimization of Evaporator Configuration and Placement," In progress.
23. W.J.S. Dolla, "Analysis of Refrigeration Systems for Food Storage," In progress.

Bachelor of Science Honors:

1. K.E. Stogsdill, "Development of a Hot Water Usage Database," Winter 1989.
2. E.C. Meinking, "A Computational Parametric Study of Elementary School Energy Usage," Summer 1989.
3. T.M. Walter, "Optimization of a Counterflow Cooling Tower Design Using the Finite Element Method," Summer 1989.
4. B.A. Fricke, "Development of Correlations for Soil Thermal Conductivity," Winter 1992.
5. W.R. Davis, III, "Freeze Drying as a Modeling Topic," Winter 1997.

Bachelor of Science Project Reports:

1. T.H. Camper, "Temperature Sensitive Valve Design," Fall 1988.
2. S.V. Lister, "Simulation of Assembly Process," Fall 1989.
3. D.F. LeMunyon, "Compilation of Hot Water Usage Data," Winter 1990.
4. K. Jakobe, "Compilation of Hot Water Usage Data," Fall 1990.
5. C.K. Saunders, "EPA Alternative Energy Demonstration Unit," Fall 1991.
6. C.R. Cain, "EPA Alternative Energy Demonstration Unit," Fall 1991.
7. D.A. Krawchuk, "Dune Buggy Design," Winter 1994.
8. S.A. Dumsky, "Dune Buggy Design," Winter 1994.
9. M. Herron, "A Graphical User Interface for LSLOAD," Winter 1996.
10. J.L. Brunk, "Design of a Spray Dampening System Solenoid Valve and Spray Nozzle," Winter 1998.
11. C.O. Norman, "Centrifugal Processing of Meat Products," Winter 1998.
12. C.S. Plesa, "Survey of Aerospace Propulsion Systems," Winter 2000.
13. B.A. Ravenscroft, "Bench-Top Cooling Tower Studies," Winter 2000.
14. C.A. Baker, "Bench-Top Cooling Tower Studies," Winter 2000.

Courses Taught

MAE 099 - Thermodynamics I
MAE 206 - Computer Aided Engineering
MAE 209 - Thermodynamics II
MAE 251 - Fluid Mechanics
MAE 252 - Instrumentation Lab. I
MAE 262 - Instrumentation Lab. II
MAE 299 - Heat Transfer
MAE 301 - Introduction to Computational Fluid Dynamics and Heat Transfer (Developed)
MAE 301 - Advanced Fluid Mechanics (Developed)
MAE 341 - Intermediate Fluid Mechanics
MAE 342 - Introduction to Computational Fluid Dynamics and Heat Transfer (Developed)
MAE 401 - Computational Fluid Dynamics and Heat Transfer (Developed)
MAE 401 - Viscous Fluid Flow (Developed)
MAE 401 - Fluid Mechanics Measurements (Developed)
MAE 430 - Boundary Layer Theory
MAE 435 - Conduction Heat Transfer

MAE 438 - Introduction to Turbulence
MAE 451 - Computational Fluid Dynamics

Other Teaching Activity

IEEE Fundamentals-of-Engineering/Engineer-in-Training Exam Reviews, 1987-1995.
UMC Engineering Extension Professional Engineer Registration Exam Review Course – Heat Transfer, 1996-1998.
UMC Engineering Extension Professional Engineer Registration Exam Review Course – Fluid Mechanics, 1996-1998.
UMC Engineering Extension Fundamentals-of-Engineering/Engineer-in-Training Exam Review Course - Thermodynamics, 1997-1998.
UMC Engineering Extension Fundamentals-of-Engineering/Engineer-in-Training Exam Review Course - Fluid Mechanics, 1997-1998.
Trane 2000 Air Conditioning Clinic, September 14 – December 14, 2000.

PROFESSIONAL AND UNIVERSITY SERVICE

Society Memberships

American Society of Mechanical Engineers (ASME), Member: 1980-2000, Fellow: 2000-present
Faculty Advisor to UMKC Student Section of ASME, 1991-1998, 2000-present
American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), 1990-present
Member of Research Administration Committee, 1997-1999
Chairman of Research Planning Subcommittee, 1997-1999
Member of Research and Technical Committee, 1995-1997
Member of Planning and Utilization Subcommittee, 1996-1997
Head of Technical Section 9.0, 1995-1996
Corresponding Member of Technical Committee 4.10 (Indoor Environmental Modeling), 1996-present
Member of Technical Committee 8.6 (Cooling Towers and Evaporative Condensers), 1994-1996
Corresponding Member of Technical Committee 8.6 (Cooling Towers and Evap. Condensers), 1996-present
Member of Technical Committee 10.5 (Refrigerated Distribution and Storage Facilities), 1995-present
Member of Technical Committee 10.6 (Transport Refrigeration), 2000-2004
Member of Technical Committee 10.9 (Refrigeration Applications for Foods and Beverages), 1997-present
Chairman of Technical Committee 10.9 (Refrigeration Applications for Foods and Beverages), 1994-1997
Chairman of Technical Committee 10.9 (Refrigeration Applications for Foods and Beverages), 2001-2003
Chairman of Technical Committee 11.5 (Fruits, Vegetables and Other Products), 1992-1994
Secretary of Technical Committee 11.5 (Fruits, Vegetables and Other Products), 1991-1994
Faculty Advisor to UMKC Student Section of ASHRAE, 2000-present
American Society of Engineering Educators (ASEE), 1985-present
Cooling Tower Institute (CTI), 1994-present
International Institute of Refrigeration (IIR), 1997-present
Chairman of Awards Committee of United States National Committee, 2000-2003
Member of Board of Directors of United States National Committee, 2000-2003
Member of Commission C2, (Food Science and Engineering), 2000-2003
Member of Organizing Committee, 21st International Congress of Refrigeration, sponsored by the International Institute of Refrigeration, August 17-22, 2003, Washington, D.C., 2000-2003
Phi Eta Sigma, 1967-present
Pi Tau Sigma, 1968-present
Faculty Advisor to UMKC Chapter, 2000-present
Tau Beta Pi, 1969-present

Professional Service

Conference Organizer

- 1st Annual Kansas City Life Sciences Research Day, sponsored by the University of Missouri – Kansas City and the Kansas City Area Life Sciences Institute, Inc., November 27, 2001, Kansas City, Missouri.
- 21st International Congress of Refrigeration, sponsored by the International Institute of Refrigeration, August 17-22, 2003, Washington, D.C.

Conference Session Chairmanship:

- Chair, Session 12: Refrigeration Economics, International Conference on New Developments in Refrigeration for Food Safety and Quality, October 2-4, 1996, Lexington, Kentucky.
- Chair, Forum 30: Air Side Controls for Refrigerated Storage, 2000 ASHRAE Summer Annual Meeting, June 24-28, 2000, Minneapolis, Minnesota.

Comprehensive Book Reviews:

- Review of Fundamentals of Classical Thermodynamics, Fourth Edition by G. Van Wylen, R. Sonntag, and C. Borgnakke, John Wiley and Sons, Inc., July 10, 1996.
- Review of Air Conditioning and Refrigeration, Third Edition by W.F. Stoecker, McGraw-Hill, December 9, 1996.

Paper and Presentation Reviews:

1990 - 94:	ASME Journal of Mechanical Design (4 papers)
1992 - 93:	ASHRAE Thermal Performance of the Exterior Envelopes of Buildings V (2 papers)
1993 - 94:	ASHRAE Transactions (1 paper)
	ASME 1993 Winter Annual Meeting (1 paper)
	ASME 1994 Winter Annual Meeting (3 papers)
1994 - 95:	ASHRAE Journal (2 papers)
1995 - 96:	ASME Eighth International Design Theory and Methodology Conference (1 paper)
1997 - 98:	International Journal of Heating, Ventilating, Air-Conditioning and Refrigerating Research (1 paper)
1999:	ASHRAE Transactions (1 paper)
	ASME 1999 International Mechanical Engineering Congress (1 paper)
	ASME Journal of Fluids Engineering (1 paper)
2001:	ASHRAE Transactions (2 papers)
	Chemical Engineering Communications (1 paper)
2002:	ASHRAE Transactions (1 paper)

Proposal Reviews:

1995-2002:	UM Research Board proposals (26 proposals)
1999:	National Research Council of Canada proposal (1 proposal)

Service on UM System Committees

2001 - 03: Member of UM Research Board

Service on Campus Committees

1985 - 87: Academic Awards Committee, Rose-Hulman Institute of Technology
1985 - 87: Graduate Studies Committee, Rose-Hulman Institute of Technology (Secretary)
1988 - 93: Scholar Faculty Mentor Committee, University of Missouri-Kansas City
1990 - 91: Campus Networking Committee, University of Missouri-Kansas City
1997 - 99: North Central Accreditation Steering Committee, University of Missouri-Kansas City
Urban Research and Outreach Initiative, University of Missouri-Kansas City
1998 - 99: Science Reference Librarian Search Committee, Miller Nichols Library, University of Missouri-Kansas City
1999-2000: Parking Task Force, University of Missouri-Kansas City
2001: UMKC Leading Life Sciences Innovation Blueprint Breakthrough Project
Workshop for Transforming UMKC, July 16, 18, 20, 2001
Program Committee, 1st Annual Kansas City Life Sciences Research Day, sponsored by the University of Missouri – Kansas City and the Kansas City Area Life Sciences Institute, Inc., November 27, 2001, Kansas City, Missouri
2001 - 03: UMKC Chancellor's Promotion and Tenure Advisory Committee

Service on College Committees

1988 - 1991:	CEP Scholarship Committee
	CEP Safety Committee
1988 - 1995:	CEP Computing Committee (Chairman)
1991 - 1995:	CEP Facilities Planning Committee
1994 - 1995:	CEP FAX Finding Committee (Chairman)
1994 - 1996:	Engineering Policy Committee, University of Missouri-Columbia
1996 - 2001:	CEP Faculty Coordinator, UMKC Interdisciplinary Ph.D.
2001 - 2002:	SICE Dean Search Committee
	SICE Engineering Student Service Coordinator Search Committee
2001 - present:	SICE Leadership Team
	SICE Promotion and Tenure Committee
	SICE Promotion and Tenure Procedures Committee
	SICE Engineering Coordinator, UMKC Interdisciplinary Ph.D.

Service on Departmental Committees

1987 - 1988:	UMC/MAE Long Range Planning Committee
	UMC/MAE Graduate Committee
1989 - 1990:	UMC/MAE Promotion & Tenure Procedures Committee
1990 - 1991:	UMC/MAE Computer Committee
	UMC/MAE Undergraduate Committee
1991 - 1995:	CEP/MAE Computer Committee (Chairman)
	CEP/MAE Appeals Committee
	CEP/MAE Scholarship Committee
	CEP/MAE Honors Committee
	CEP/MAE Undergraduate Committee
	CEP/MAE Graduate Committee
1992 - 1993:	CEP/MAE Faculty Search Committee (Chairman)
1993 - 2001:	UMC/MAE Promotion & Tenure Committee
1995 - 1996:	UMC/MAE Promotion & Tenure Dossier Subcommittee
1996 - 1998:	CEP/MAE Faculty Search Committee (Chairman)
1997 - 2001:	UMC/MAE Undergraduate Committee
	CEP/MAE Director of Undergraduate Studies
	CEP/MAE Director of Graduate Studies
2001 - present:	Engineering Sciences Curriculum and Student Handbook Committee (Chairman)
	Engineering Sciences Undergraduate Committee (ex-officio member)
	Engineering Sciences Graduate Committee
	Engineering Sciences Faculty Search Committee

RESEARCH AND PUBLICATIONS

External Research Grants

1. USAFOSR/UES, 1/1/88 - 4/1/89, "A Numerical Study of the Flow Field and Heat Transfer in a Rectangular Passage with a Turbulator," $19,755, Principal Investigator.

2. USAFOSR, 1/1/89 - 1/1/90, Computing budget funded by U.S. Air Force Aero Propulsion Lab to Perform A Numerical Investigation of the Aero Thermal Mechanics in a Rectangular Passage with Multiple Turbulators, $10,870, Principal Investigator.

3. AGAL, 3/1/90 - 7/31/90, "Development and Analysis of Hot Water Usage Database," $9,998, Principal Investigator.

4. Marley Cooling Tower Company, 9/1/90 - 8/31/91, "Effect of Drift Eliminator Design on Cooling Tower Performance," $20,597 (grant-in-kind), Principal Investigator.

5. USEPA, 9/1/90 - 7/31/91, "A Student Design Competition to Develop a Prototype Alternative Energy Demonstration Unit," $6,000, Principal Investigator.

6. Marley Pump Company, 3/1/91-3/1/92, "Thermofluid Mechanics Research," $12,500 (unrestricted cash gift), Principal Investigator.

7. U.S. Army-CERL, 6/1/91-11/1/91, "Combined Forced and Buoyancy Driven Downward Impinging Flows," $20,000, Co-Principal Investigator.

8. EPRI, 7/16/91-7/19/91, Travel Grant to speak as Invited Lecturer at the EPRI Water Heating Interest Group Meeting, $1007, Principal Investigator.

9. ASHRAE, 9/1/91-8/31/93, "Development of a Design Procedure for Thermal Energy Storage Tanks Utilizing Technologies which Separate the Manufacture of Ice from the Storage of Ice (707-RP)," $93,598, Co-Investigator.

10. Kansas City Power and Light Company, 1/1/92-12/31/97, "Development of Dual Register Burner Models and Adjustment Strategy," $45,436, Principal Investigator.

11. U.S. Army-CERL, 3/1/92-8/1/92, "Numerical Model of Side Slot Flows for Thermal Stratification," $20,000, Co-Principal Investigator.

12. International Copper Association, Ltd., 1/1/93-1/1/94, "Development of a Copper or Copper Alloy-Based Heat Exchanger for Dry and Wet/Dry Cooling Towers, Phase I: Assessment of the State of the Art and Future Copper Business Opportunities," $49,995, Principal Investigator (BECO).

13. Kansas City Power and Light Company, 1/1/93-12/31/97, "Analysis of Heat Transfer Components," $89,989, Principal Investigator.

14. ASHRAE, 7/1/93-6/30/94, "Grant-in-Aid for Graduate Students," $7,500, Principal Investigator.

15. ASHRAE, 4/1/93-3/31/94, "Evaluation of Service Hot Water System Distribution Losses in Residential and Commercial Installations (696-RP)," $79,105, Co-Investigator.

16. ASHRAE, 4/1/93-9/30/95, "Computer Algorithms for Moisture Loss and Latent Heat Loads in Bulk Storage of Fruits and Vegetables (777-RP)," $81,544, Principal Investigator.

17. ASHRAE, 4/1/94-3/31/96, "Experimental Determination of Heat Transfer in Water Cooled Condensers and Direct Expansion Water Coolers Using Brazed Plate Heat Exchangers (752-RP)," $89,111, Co-Principal Investigator.

18. Kansas City Power and Light Company, 1/1/95-9/30/96, "Utilization of Western Coal Fly Ash in the Construction of Highways in the Midwest," $50,000, Co-Investigator.

19. EPRI, 4/1/95-3/31/96, "EPRI Simulator and Training Center Administration," $39,398, Co-Investigator.

20. USDOT, 9/1/95-8/31/96, "Mid-America Transportation Center," $131,122, Co-Investigator.

21. ASHRAE, 4/1/96-7/1/97, "Computer Algorithms for Calculating the Cooling and Freezing Times, Refrigeration Loads and Thermal Properties of Foods and Beverages (888-RP)," $89,158, Principal Investigator.

22. EPRI, 4/1/96-12/31/97, "EPRI Simulator and Training Center Administration," $107,397, Co-Investigator.

23. EPRI, 1/1/98-12/31/98, "Continuation of EPRI Simulator and Training Center Administration," $67,740, Principal Investigator.

24. ASHRAE, 4/1/99-9/30/00, "Determination of Heat Transfer Coefficients for Cooling and Freezing of Food Items, Phase I (1123-RP)," $87,500, Principal Investigator (BECO).

25. ASHRAE, 9/1/99-2/28/01, "Methods to Calculate the Cooling Times and Loads of Fruits and Vegetables Using Hydrocooling (1138-RP)," $58,594, Principal Investigator (BECO).

26. Kansas City Power and Light Company, 1/1/00-12/31/02, "Development of Condenser Models," $121,865, Principal Investigator.

27. Combustion Byproducts Recycling Consortium, 2/1/01-1/31/03, "Crushed Aggregates from Class C Fly Ash," $76,563, Co-Investigator.

28. Kansas City Power and Light Company, 2/1/01-1/31/03, "Crushed Aggregates from Class C Fly Ash," $20,061, Co-Investigator.

29. Monsanto Integrated Protein Technologies, 1/1/01-12/31/03, "Bulk Freezing of Protein Solutions," $265,726, Principal Investigator.

30. ASHRAE, 9/1/01-8/31/03, "Development of a Design Guide for Refrigerated Food Storage Facilities (1214-RP)," $77,500, Principal Investigator (BECO).

Internal Grants

1. UMKC International Travel Fellowship, 3/15/88, 33rd ASME International Gas Turbine and Aeroengine Congress, Amsterdam, The Netherlands, $350.

2. UMKC International Travel Fellowship, 7/21/94, 9th Cooling Tower and Spraying Pond Symposium, von Karman Institute, Rhode-Saint-Genèse, Belgium, $350.

3. Proposal for an Interdisciplinary Bioengineering Focus at UMKC, 7/23/01, $2,876,778.

Journal Publications

1. Becker, B. R., "A Numerical Model of Moist Plume Thermodynamics," Transactions of the ASME, Journal of Engineering for Power, Vol. 106, No. 4, pp. 765-770, October, 1984.

2. Becker, Bryan R. and John B. Drake, "Finite Element Analysis of Time Dependent Viscous Flows Utilizing an Implicit Mixed Interpolation Algorithm with a Frontal Solution Technique," International Journal of Mathematical Modelling, Vol. 7, No. 2/3, pp. 469-482, 1986.

3. Becker, Bryan R. and John B. Drake, "The Application of an Implicit Finite Element Algorithm with a Frontal Solution Technique to the Analysis of Time Dependent Viscous Flows," International Journal of Mathematical Modelling, Vol. 8, pp. 245-250, 1987.

4. Becker, B. R., W. E. Stewart, Jr., T. M. Walter, and C. S. Becker, "A Numerical Model of Cooling Tower Plume Recirculation," Mathematical and Computer Modelling, Vol. 12, No. 7, pp. 799-819, July, 1989.

5. Stewart, W. E., Jr., B. R. Becker, L. A. Stickler, and M. E. Greer, "Approximate Attic Air Temperatures and Ceiling Heat Fluxes with Radiant Barriers," ASHRAE Transactions, Vol. 95, Pt. 2, pp. 244-249, December, 1989.

6. Becker, Bryan R. and Carol S. Becker, "The Flow Field and Heat Transfer Near a Turbulator," International Communications in Heat and Mass Transfer, Vol. 17, No. 4, pp. 455-464, July/August, 1990.

7. Becker, Bryan R. and Kevin E. Stogsdill, "A Domestic Hot Water Use Data Base," ASHRAE Journal, Vol. 32, No. 9, pp. 21-25, September, 1990.

8. Stewart, W. E., Jr., B. R. Becker, M. E. Greer, and L. A. Stickler, "An Experimental Method of Approximating Effective Heat Transfer Coefficients for Food Products," ASHRAE Transactions, Vol. 96, Pt. 2, pp. 142-147, December, 1990.

9. Becker, B. R. and E. C. Meinking, "A Computational Parametric Study of Elementary School Energy Use," ASHRAE Transactions, Vol. 96, Pt. 2, pp. 233-238, December, 1990.

10. Becker, B. R. and K. E. Stogsdill, "Development of a Hot Water Use Data Base," ASHRAE Transactions, Vol. 96, Pt. 2, pp. 422-427, December, 1990.

11. Becker, B.R., W.H. Thrasher, and D.W. DeWerth, "Comparison of Collected and Compiled Existing Data on Service Hot Water Use Patterns in Residential and Commercial Establishments," ASHRAE Transactions, Vol. 97, Pt. 2, pp. 231-239, December, 1991.

12. Becker, Bryan R., Anil Misra, and Brian A. Fricke, "Development of Correlations for Soil Thermal Conductivity," International Communications in Heat and Mass Transfer, Vol. 19, No. 1, pp. 59-68, January/February, 1992.

13. Lai, Yew Chin, Bing Yuan Ting, Woon Sung Lee and Bryan R. Becker, "Dynamic Response of Beams on Elastic Foundation," ASCE, Journal of Structural Engineering, Vol. 118, No. 3, pp. 853-858, March, 1992.

14. Becker, Bryan R. and Larry F. Burdick, "Effect of Drift Eliminator Design on Cooling Tower Performance," Transactions of the ASME, Journal of Engineering for Gas Turbines and Power, Vol. 114, No. 4, pp. 632-642, October, 1992.

15. Becker, Bryan R. and Larry F. Burdick, "A Methodology for the Evaluation of Cooling Tower Fan System Performance as Influenced by Drift Eliminator Design," ASHRAE Transactions, Vol. 98, Pt. 2, pp. 3-14, December, 1992.

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RESEARCH: ACHIEVEMENTS AND CURRENT INTERESTS

Dr. Becker's research and scholarly activity has centered around heat transfer and fluid flow phenomena especially those encountered in energy systems and, most recently, food refrigeration. He is primarily recognized for his research in the modeling and numerical analysis of heat and mass transport and freezing phenomena in food storage and refrigeration. His work on transport phenomena and thermal processes for foods forms a rigorous, technically sound foundation, based on fundamental principles, for the design and implementation of food cooling, freezing and storage operations. In addition, he has a technically diverse research record which spans more than 25 years.

While at the Oak Ridge National Laboratory, Dr. Becker developed numerical techniques to analyze the thermal-hydraulics of high temperature gas cooled reactors, the thermal safety of nuclear waste shipping casks, and the fluid flow and heat transfer in gas centrifuges for uranium enrichment. In addition, Dr. Becker modeled turbulent atmospheric flow over a mechanical draft cooling tower, moist plume thermodynamics and cooling tower performance. He also developed a general purpose finite element algorithm for viscous incompressible fluid flow.

While at Rose-Hulman Institute, Dr. Becker continued his cooling tower research by developing a finite element model of cooling tower flows incorporating nonlinear, anisotropic hydraulic mass conductivities.

Since joining the University of Missouri, Dr. Becker has focused on applied energy research. During his 1987 and 1988 Summer Research Fellowships at the USAF Aero Propulsion Laboratory, Dr. Becker modeled the fluid flow and heat transfer in gas turbine blade cooling passages. He has since completed a number of applied energy research projects with funding from a variety of sources. He has studied energy consumption in public buildings, developed a service hot water use database and an alternative energy demonstration unit. He has experimentally investigated cooling tower drift eliminator design and developed correlations of soil thermal conductivity. Dr. Becker has also numerically modeled the fluid flow in chilled water storage systems. In addition, he has developed a design procedure for thermal storage tanks and an empirical model of industrial process fouling. Dr. Becker has also developed both numerical and physical models of dual register, pulverized coal burners and analyzed the life cycle of feedwater heaters. Furthermore, he has evaluated service hot water system distribution losses, the performance of brazed plate heat exchangers, and the utilization of fly ash as a construction material. He is currently developing models to analyze the performance of steam condenser bundles and the impact of condenser performance upon power plant operating costs.

Most recently, Dr. Becker has numerically predicted the moisture loss and latent heat loads in the bulk storage of fruits and vegetables and modeled the cooling and freezing times, refrigeration loads and thermal properties of foods and beverages. He is currently studying the hydrocooling of fruits and vegetables, and determining the heat transfer coefficients of some 1000 food items using forced-air belt freezing systems.