

**BYARD D. WOOD**  
**Professor and Head**  
**Mechanical and Aerospace Engineering**  
**Utah State University**

**Degrees:**

PhD University of Minnesota, Mechanical Engineering, 1970  
MSME Utah State University, Mechanical Engineering, 1966  
BSME Utah State University, Mechanical Engineering, 1963  
AA Boise State University, 1960

**Academic Experience:**

2003- Utah State University, Head and Professor, Mechanical & Aerospace Engineering  
1997-03 University of Nevada, Reno; Chair and Professor, Department of Mechanical Engineering  
1986- 96 Arizona State University, Director, Center for Energy Systems Research  
1983-86 Arizona State University, Acting Director, Center for Energy Systems Research  
1979-97 Arizona State University, Professor, Department of Mechanical and Aerospace Engineering  
1974-79 Arizona State University, Associate Professor of Engineering, Mechanical Engineering Faculty  
1973-75 Arizona State University, Assistant Chairman, Mechanical Engineering Faculty  
1970-74 Arizona State University, Assistant Professor of Engineering, Mechanical Engineering Faculty  
1967-70 University of Minnesota, Research Assistant  
1965-66 Utah State University, Instructor  
1964-65 Utah State University, Research Assistant

**Industrial and Consulting Experience:**

1996- 05 Executive Director, Solar Rating & Certification Corporation  
1986-96 Technical Director, Solar Rating & Certification Corporation  
1980-86 Servamatic Systems, Inc.  
1979- ERG, Inc.  
1977-80 Solar Energy Research and Education Foundation, Solar Energy Industries Association  
1977 Mechanical Engineer, Thermal Engineering Section, National Bureau of Standards  
1974- Consultant, Solar Energy Applications and Energy Conservation in Buildings  
1974-77 Short Course Lecturer, Solar Energy Applications for Heating and Cooling Buildings, Arizona State University and Boise State University  
1973-74 Short Course Lecturer, Measurement Systems Engineering Short Courses, Arizona State University  
1963 The Trane Company, Laboratory Development Engineer

**Current Professional Society Memberships and Activities:**

Registered Professional Mechanical Engineer, AZ No. 9413 and NV No. 018828  
ASME: Fellow Member  
ASHRAE: Fellow/Life Member  
International Solar Energy Society: Member  
American Solar Energy Society: Member, Technical Session Chair ASES 2002 Annual Mtg, 2004 Charles Greeley Abbot Award  
International Desalination Association, Member  
American Society of Engineering Educators, Member

**Principal Areas of Research and Teaching:**

Research: Heat and Mass Transfer Phenomena, Algal Based Biofuels, and Solar Energy Utilization  
Teaching: Heat Transfer, Thermodynamics, Experimental Measurements, Solar Energy, Energy Systems Engineering, Engineering Design  
Number of Graduate Student Degrees 1970 - 2008: 61 MS, 15 PhD  
Total publications: 100+ and numerous energy assessment reports

## **Undergraduate Student Projects**

In 1989, Dr. Wood founded the Arizona Horizon Project which sponsored Arizona State University's participation in design competitions centered around solar powered vehicles and electric powered race vehicles. The Project was established as an extracurricular activity to facilitate undergraduate student participation in national intercollegiate design competitions. Its mission was to enhance the academic experience with a "hands-on-real-world" experience in product development team from design to functioning prototype. Under his leadership the ASU Horizon Project team designed and built four race cars (two solar and two electric race cars.) They competed in sixteen events in both oval track and road races in the US and Japan. His teams were very competitive in a number of competitions, having won two races and placed fourth or higher in seven races. While he was the principal faculty advisor (1989-1996), more than 400 undergraduate students contributed tens of thousands of labor hours towards the design, fabrication, testing and racing of the four vehicles.

In addition the Arizona Horizon Project, he has supervised 159 senior design projects at Arizona State University, University of Nevada, Reno and Utah State University.

## **Selected Publications**

*Economic analysis of a vertical sheet algal photobioreactor for biodiesel production*, P. Zemke, B. Wood, D. Dye, D. Bayless, J. Muhs, Proceedings of ES2007 Energy Sustainability 2007, July 27-30, Long Beach, CA, Paper No. ES2007-36055.

*Demonstration of Infrared-Photovoltaics for a Full-Spectrum Solar Energy System*, D. Dye, B.D. Wood, L. Fraas, and J. Kretschmer, Journal of Solar Energy Engineering, Vol. 128, No. 1, pp 30-33, 2006

*Self-Powered full-spectrum solar lighting system*, D. Dye and B. Wood, SPIE Newsroom (10.1117/2.1200605.0259) Oct 2006

*Long term testing for dropwise condensation using self-assembled monolayer coatings on n-octadecyl mercaptan*, S. Vermuri, K. Kim, B. Wood, Govindaraju, and T. Bell, Applied Thermal Engineering, Mar 2006

*Demonstration of Infrared-Photovoltaics for a Full-Spectrum Solar Energy System*, D. Dye, B. Wood, L. Fraas, and J. Kretschmer, ASME Journal of Solar Energy Engineering, Jan 2004

*Prediction of Light-Transmission Losses in Plastic Optical Fibers*, Murat Tekelioglu and Byard D. Wood, *Applied Optics*, Vol. 44 No. 12, 20April2005

*Optical Design of an Infrared Non-Imaging Device for a Full-Spectrum Solar Energy System*, D. Dye, B. Wood, L. Fraas, J. Muhs; Journal of Solar Energy Engineering, Vol. 126, No. 1, pp 676-679, 2004

*Analysis of a Full Spectrum Hybrid Lighting System*, G.O. Schlegel, F.W. Burkholder, S.A. Klein, W.A. Beckman, B.D. Wood, J.D. Muhs, Solar Energy, Vol 76, pp 359-368, 2004

*The Effect of Nano-Tailored Surfaces on Steam Condensation*, S. Vermuri, K.J. Kim, B.D. Wood, S. Govindaraju, T.W. Bell, Proceedings of IMECE 2003 International Mechanical Engineering Congress and RD&D Expo, November 15-21, Washington DC, Paper IMECE2003-43083

*Demonstration of Thermophotovoltaics for Full-Spectrum Solar Energy System*, Dan Dye, Byard Wood, Lewis Fraas, Jeanette Kretschmer, Proceedings ASME International Solar Energy Conference Solar 2004, paper # 65125, July 11-14, 2004

*Thermal Management of the Polymethylmethacrylate (PMMA) Core Optical Fiber for Use in Hybrid Solar Lighting*, Murat Tekelioglu and Byard D. Wood, Proceedings ASME International Solar Energy Conference, March 2003

*Experimental results for a hydraulic refrigeration system using n-butane*, Chau, David S., Kent Whitfield, Byard Wood, Warren Rice, and Patrick Phelan, International Journal of Refrigeration, Vol. 24, pp 325-337, 2001

*Cold Spot Regions in the Ice Production by Direct Contact Refrigeration*, Ricardo Ramirez-Vargas and Byard D. Wood, Proceedings of the AIChE 2001 Annual Meeting,, Session 01C12, Nov 2001.

*Packaged Solar Water Heating Technology – Twenty Years of Progress*, Graham L. Morrison and Byard D. Wood, Renewable Energy World Review Issue 2000-2001, Jul-Aug 2000, PP. 170-183.

*Feasibility of Lowering the Condenser Inlet Water Temperature of Chillers using Thermal Water Storage*, Joel Asrael, Patrick Phelan, and Byard Wood, Applied Energy Journal Vol. 66, pp. 339-356, 2000.

*The Effects Of Equalization Frequency On Flooded Lead-Acid Batteries Used In Stand-Alone Photovoltaic Hybrid Systems*, Amy C. Hoagberg, Byard D. Wood, Robert Hammond, Peter Johnston, Patrick E. Phelan, Proceedings of Solar 2000 ASME Technical Session June 16 – 21, 2000—Madison, WI

*Theoretical Modeling of Ice Formation using a Direct Contact Heat Exchange Method*, David S.C. Chau, David, Patrick E. Phelan, and Byard D. Wood, Proceedings of ASME International Mechanical Engineering Congress & Exposition, Nov 5-10, 2000 Orlando, FL

*Analysis of the Conductive Resistance of Double-Walled Heat Exchangers*, H. Xu, P.E. Phelan and B.D. Wood, Proceedings of the 1999 ASME Renewable and Advanced Energy Systems for the 21<sup>st</sup> Century Conference, Maui, Hawaii April 11-14, 1999

*Theoretical Modeling of the Freezer for a Freeze Desalination Plant*, D.S.C. Chau, B.D. Wood, and P.E. Phelan, Proceedings of the International Desalination Association World Congress on Desalination and Water Reuse, San Diego, CA, August 29 – September 3, 1999, Vol. III, pp. 171-182 (Proceedings distributed on CD-ROM)

*The Minimum Separation Work for Desalination Processes*, Yunus Cerci, Yunus A. Cengel, and Byard Wood, Proceedings of Symposium on Thermodynamics and the Design, Analysis, and Improvement of Energy Systems, ASME International Mechanical Engineering Congress and Exposition, Nashville, Tennessee, November 14-19, 1999

*Simplified Model for Radiant Heat Transfer Analysis of Tubular Integral-Collector-Storage Absorber Surfaces*, Jorge R. Barral and Byard D. Wood, Proceedings of LATCYM 98, Iniqui Instituto de Investigaciones para la Industria Quimica, Volumen IV, Salta, Argentina, pp990-995, October 5-8, 1998

*Experimental Results For A Hydraulic Refrigeration System Using N-Butane As The Refrigerant*, David S. Chau, Warren Rice, Patrick E. Phelan, Kent L. Whitfield, and Byard D. Wood, AIAA/ASME Joint Thermophysics and Heat Transfer Conference, June 15-18, 1998, Albuquerque, New Mexico.

*Components for Freeze Desalination Using Hydraulic Refrigerant Compressors (HRC's)*, Warren Rice, David S.C. Chau, and Byard D. Wood, Proceedings, IDA World Congress on Desalination and Water Reuse, International Desalination Association, Madrid Spain, Oct 6-9, 1997

*Solar Assisted Open-Cycle Absorption Cooling: Performance of Collector/Regenerator*, M.N.A. Hawlader, B.D. Wood, C.C. Folkman and A.P. Stack, International Journal of Energy Research, Vol. 21, pp. 549-574 (1997)

*Measurement Of Small Concentrations Of Gas In A Low Pressure Water Vapor Mixture*, T.A. Ameel, K.J. Kim, And B.D. Wood, Journal of Thermophysics And Heat Transfer, Vol. 11, No. 4, Pp. 582-585, 1997.

*Non-Absorbable Gas Effects On Heat And Mass Transfer In Wavy Laminar Falling Film Absorption*, T.A. Ameel, K.J. Kim, And B.D. Wood, Solar Energy, Vol. 60, No. 6, Pp. 301-311, 1997.

- Performance Evaluations of LiCl and LiBr for Absorber Design Applications in the Open-Cycle Absorption Refrigeration System*, K.J. Kim, T.A. Ameel and Byard Wood, *Journal of Solar Energy Engineering, Transactions of The ASME*, Vol. 119, pp 165-173, May 1997
- The Interfacial Turbulence in Falling Film Absorption: Effects of Additives* Kwang J. Kim, Neil S. Berman and Byard D. Wood, *International Journal of Refrigeration*, Vol. 19, No. 5 pp322-330, 1996
- Solar Hot Water Heaters for the Home* Jane Davidson and Byard Wood, *Mechanical Engineering* pp 60-62, August 1996
- Effects of Non-Absorbable Gas on Interfacial Heat and Mass Transfer for the Entrance Region of a Falling Film Absorber*, T.A. Ameel, H.M. Habib and B.D. Wood, *Journal of Solar Energy Engineering, Transactions of The ASME*, Vol. 118, pp 45-49, Feb 1996
- Absorption Of Water Vapor Into Falling Films Of Aqueous Lithium-Bromide*, K.J. Kim, N.S. Berman, D.S.C. Chau, and B.D. Wood, *International Journal of Refrigeration*, Vol. 18, No. 7, Pp486-494, 1995
- Performance Predictions Of Alternative Low Cost Absorbents For Open-Cycle Absorption Solar Cooling*, T.A. Ameel, K.G. Gee and B.D. Wood, *Solar Energy*, Vol. 54, No. 2, Pp. 65-73, 1995
- Surface Tension of Aqueous Lithium Bromide + 2-Ethyl-1-Hexanol*, K.J. Kim, N.S. Berman and B.D. Wood, *Journal of Chemical and Engineering Data*, Vol. 39, pp. 122-124, 1994.
- Performance Predictions of Solar Open Cycle Absorption Air Conditioning Systems in Three Climatic Regions*, T.A. Ameel, D.A. Siebe, B.D. Wood, and R.K. Collier), *Journal of Solar Energy Engineering, Transactions of the ASMAE*, Vol. 116, pp. 107-113, May 1994.
- Control Problems in Solar Domestic Hot Water Systems*, W.A. Beckman, J. Thornton, S.M. Long, and B.D. Wood, *Solar Energy*, Vol. 53, No. 3, pp. 233-236, 1994
- Unglazed Collector/Regenerator Performance for a Solar Assisted Open Cycle Absorption Cooling System* M.N.A. Hawlader, K.S. Novak, and B.D. Wood, *Solar Energy*, Vol. 50, No. 1, pp. 59-73, 1993.
- Absorber Performance Studies for Open-Cycle Solar Absorption Cooling Systems*, T.A. Ameel, D.A. Siebe and B.D. Wood, *Proc. ASME International Solar Energy Conference, Solar Engineering*, pp. 177-188, April, 1993.
- Development of a Regional Energy and Environment Sustainability Model and its Application to Solar Domestic Hot Water Systems*, M. Reker and B.D. Wood, *Proc. 1993 Solar Energy Forum, ASES*, Vol. 2, April 1993.
- A Comparison of TRNSYS and Watsun for the Development of a SDHW Modeling Program*, S. Long and B.D. Wood, *Proc. 1993 Solar Energy Forum, ASES*, Vol. 1, April 1993.
- Performance Enhancement Study of Solar Collector/Regenerator for Open Cycle Liquid Desiccant Regeneration*, L.J. Ji and B.D. Wood, *Proc. 1993 Solar Energy Forum, ASES*, Vol. 1, April 1993.
- Simulation-based Ratings for Solar Hot Water Systems*, B.D. Wood, J.D. Burch, J. Huggins and J. Thornton), *Proc. 1993 Solar Energy Forum, ASES*, Vol. 1, April 1993.
- A Numerical Investigation of Natural Convection Heat and Mass Transfer from Uniformly Heated Falling Films in Vertical Channels*, G.A. Buck and B.D. Wood, *ASAE Journal of Solar Energy Engineering*, Vol. 115, No. 1, pp. 42-51, February 1993.
- Non-Absorbable Gas Effects In Heat and Mass Transfer in Wavy Laminar Falling Film Absorber*, T.A. Ameel and B.D. Wood, *Solar Energy Engineering 1992*, Vol. I, p. 219, The American Society of Mechanical Engineers, April 1992.
- The Arizona Horizon Project: Saga of the Sun Devil Cruiser*, D.S.C. Chau, L.S. Heywood and B.D. Wood, *Solar Energy Engineering 1992*, Vol. I, p. 565, The American Society of Mechanical Engineers, April 1992.
- A Numerical Modeling of an Absorption Process on a Liquid Falling Film*, R. Yang and B.D. Wood, *Solar Energy*, Vol. 48, No. 3, p. 195, 1992.

*Performance Evaluation of Glazed and Unglazed Collectors/Regenerators in a Liquid Absorbent Open-Cycle Absorption Cooling System*, M.N.A. Hawlader, A.P. Stack and B.D. Wood, *International Journal of Solar Energy*, Vol. 11, pp. 135-164, 1992.

*Use of the Analytic Hierarchy Process in the Development of a Regional Energy and Environment Sustainability Model*, D.L. Kezell and B.D. Wood, Proc. 1991 Solar World Congress, ISES, Vol. 3, August 1991.

*Feasibility Assessment and Environmental Benefits of Photovoltaic Power Systems*, M.E. Zaarour and B.D. Wood, Proc. 1991 Solar World Congress, ISES, Vol. 1, August 1991.

*Open-Cycle Absorption Solar Cooling: Glazed and Unglazed Open Flow Liquid Absorbent Solar Collector/Regenerator*, M.N.A. Hawlader, A.P. Stack and B.D. Wood, Proc. 1991 Solar World Congress, ISES, Vol. 2, August 1991

*A Numerical Solution of the Wavy Motion on a Falling Liquid Film*, R. Yang and B.D. Wood, *Canadian Journal of Chemical Engineering*, Vol 69, pp. 723-728, June 1991.

*The Real Value of Solar Domestic Hot Water Systems*, B.D. Wood and J. He), Proc. Cooperative Clean Air Technology, Air and Waste Management Asssociation, SP-83, March 29-April 1, 1992.

*Effects of a Non-Absorbable Gas on the Heat and Mass Transfer for the Entrance Region of a Falling Film Absorber*, H.M. Habib, T.A. Ameen and B.D. Wood, Proc 1991 ASME-JSME-JSES International Solar Energy Conference, March 1991.

*Simultaneous Heat and Mass Transfer for a Falling Film Absorber -- The Two Phase Flow Problem*, H.M.. Habib and B.D. Wood, Proc. 12th Annual ASME International Solar Energy Conference, pp. 61-67, April 1990.

*Evaporation Rate Model for a Natural Convection Glazed Collector/Regenerator*, D.J. Nelson and B.D. Wood, ASME Transactions, *Journal of Solar Energy Engineering*, Vol. 112, pp. 51-57, February 1990.