

David H. Swan

Summary: Twenty-eight years of professional research, development and commercialization experience in energy conversion and storage systems. David is committed to the advancement of clean and efficient energy conversion and storage devices.

EDUCATION

Ph D	Texas A&M University, 1990, Experimental <u>Fluid Dynamics</u>
M ScE	University of New Brunswick, 1982, <u>Heat Transfer</u>
B Eng	Technical University of Nova Scotia, 1979, <u>Mech. Engineering</u>
B Sc	Dalhousie University, Nova Scotia, 1977, <u>Mathematics</u>
Dipl of Eng	Dalhousie University, Nova Scotia, 1977, <u>Engineering Science</u>

EXPERIENCE

- 2003 - 2009 President and Owner, DHS Engineering Inc., Nova Scotia: Responsible for engineering services to OEMs (automotive, locomotive, utilities) specializing in hybrid, electric vehicle and hydrogen development programs.
- 2008 - 2009 President and Owner, In-Stream Engineering Inc., Nova Scotia: Consulting in the modeling design and implementation of in-stream water turbines.
- 2001 - 2003 President and Owner, EnergyCS Inc. Monrovia, California: Responsible for energy storage systems and engineering to automotive OEMs.
- 1995 - 2000 Chief Scientist/Senior Manager, AeroVironment Inc., Monrovia, California: Responsible for all energy storage activities at AeroVironment. The Energy Storage Systems Group developed and integrated complete battery systems for electric and hybrid vehicles as well as develop fuel cell and hydrogen energy storage systems for AeroVironment's solar-powered aircraft. Responsible for all aspects of the General Motors hybrid vehicle battery program 1995 through 1998.
- 1993 - 1995 Research Professor, University of California, Davis, Institute of Transportation Studies: Responsible for the Fuel Cell and Battery Engineering Laboratory and research activities. Developed and taught courses in applied electrochemistry and supervised graduate students.
- 1987 - 1992 Assistant Director, Center for Electrochemical Systems and Hydrogen Research, Texas A&M University: Initiated and coordinated electric and hydrogen vehicle research and development programs. Established the South Central Electric Vehicle Consortium (14 industrial members).
- 1979 – 1985 Senior Engineer, Nova Energy Limited, Halifax, Nova Scotia: Responsible for modeling, design and construction of in-stream Vertical Axis Water Turbines (VAWT). Supervised the work of design engineers, construction contractors, turbine installation and testing.

PROFESSIONAL POSITIONS HELD

<u>Expert Panel Member</u>	California Air Resources Board ZEV Technology
<u>Technical Committee Member</u>	Partnership for New Generation Vehicle
<u>Technical Committee Member</u>	Ballard Power Systems
<u>Executive Director and Founder</u>	South Central Electric Vehicle Consortium
<u>Committee Member</u>	Locomotive Propulsion Task Force, SCAQMD, CA
<u>Committee Member</u>	Arizona Public Service, Electric Vehicle Safety
<u>Committee Member</u>	Project California, Fuel Cells, Long Term R&D

NON- CONFIDENTIAL CONSULTING

- California Air Resource Board
- California Legislature Subcommittee for Industrial Development
- World Resources Institute
- U.S. Senate Subcommittee, Environment and R&D

PROFESSIONAL ASSOCIATIONS

- Current Member of The Association of Professional Engineers of Nova Scotia
- Past Member of Society of Automotive Engineers 1990 to 2002
- Past Member of American Society of Mechanical Engineers 1993 to 2000

OTHER PROFESSIONAL ACTIVITIES

- Expert technical witness in legal trials, 2004 New York, NY and 2006 Dartmouth,NS
- Judge - Los Angeles County Science Fair (2003)
- Tour de Sol First Place, May 2000 Production Class (using personal EV1)
- World Land Speed Record for Electric Vehicles (Oct. 1999, FIA Certified 395 km/hr)
- The Grove Fuel Cell Symposium, London, 1999, technical presentation winner
- SAE Congress, 1997, 1998, 1999, electric vehicle session organizer
- Developed and taught a professional Fuel Cell Technology course for the Electrochemical Society, 1997
- APS Electric Road Race, winner of the Super Stock Division 1995, 1996, 1997
- Organized and directed four university student electric vehicle race teams at Texas A&M and UC Davis
- Provided written and graphical material to McGraw Hill Science textbooks, New York Times and Time magazine.
- Provided lectures to the Science, Technology and Youth Series for High School Seniors and Science Teachers and to the Gifted Children of Texas
- Organizer of the First Society of Automotive Engineers Fuel Cells for Transportation Conference, Washington D.C., November 1991

PATENTS

- US Patent 7507500 “Design of a Large Battery Pack for a Hybrid Locomotive”, 2009
- US Patent 7124691 “Method for Monitoring and Controlling Locomotives” 2006
- US Patent 7084602, “Predicting Wheel Slip and Skid in a Locomotive” 2006
- US Patent 6682841, “Thermal Management for a Vehicle Mounted Fuel Cell System” 2004
- U.S. Patent 5856037 “Battery Venting System and Method” 1999
- US Patent Application 20070111089 “Electrochemical Cell for Hybrid Electric Vehicle Applications”
- US Patent Application 20080007220 “Vehicular Battery Charging Method ”
- Canada Patent Application 2537037 “A Method for Monitoring and Controlling Locomotives” 2006
- Canada Patent Application 2556554 “Managing Wheel Slip and Skid in a Locomotive” 2005
- Canada Patent Application 2661100 “Electrochemical Cell for Hybrid Electric Vehicle Applications”
- International Patent Application PCT/US2005/017393 “Design of a Large Battery Pack for a Hybrid Locomotive” 2005

PUBLICATIONS AND SYMPOSIUM PAPERS

PUBLIC REPORT

1. Kalhammer F., B.Kopf, D. Swan, V. Roan and M. Walsh, ‘Status and Prospects for Zero Emissions Vehicle Technology’ Report of the ARB Independent Expert Panel 2007. State of California Air Resources Board, Sacramento. <http://www.arb.ca.gov/msprog/zevprog/zevreview/zevreview.htm>

Fluid Mechanics and Gas Dynamics

1. Morrison G.L., D.H. Swan, and R.E. DeOtte, "Development of the Mean Velocity Distribution in Rectangular Jets", AIAA Paper No. 92-0505, 1992.
2. Morrison G.L. D.H. Swan, and R.E. DeOtte “Advantages of Orthogonal and Non-Orthogonal 3-D LDA Systems”, Flow Measurements and Instrumentation, April 1991, Vol 2, pp 89-97.
3. Morrison G.L. D.H. Swan, M.C. Johnson, and R.E. DeOtte, "Advantages of Orthogonal and Non-Orthogonal 3-D LDA Systems", Fifth International Symposium on Applications of Laser Techniques to Fluid Mechanics, Lisbon, Portugal, July, 1990.
4. Morrison G.L. and D.H. Swan, "Vorticity, Turbulence Production and Turbulence Induced Accelerations in a Rectangular Jet as Measured Using 3-D LDA", AIAA Paper No. 90-0363, 1990.
5. Morrison G.L. and D.H. Swan, "Three Dimensional Flow Field Measurements of a 4:1 Aspect Ratio Subsonic Jet", AIAA Paper No. 89-1092, 1989.
6. Swan and G.L. Morrison, "Eddy Viscosity Measurements in a Rectangular Jet", Proceedings of the Fourth International Symposium on Applications of Laser Anemometry to Fluid Mechanics, July 11 to 14, 1988, Lisbon, Instituto Superior Tecnico, Mech. Eng. Dept. 1096 Lisbon, Portugal, 1988.
7. D.H. Swan, G.L. Morrison and G.B. Tatterson, "3-D LDA Study of a Rectangular Jet", AIAA Paper No. 88-0183, 1988.
8. G.L. Morrison, D.H. Swan and G.B. Tatterson, "Rectangular Subsonic Jet Flow Field Study", AIAA Paper No. 87-2732, 1988.
9. Fare T.D., B.D. Pratte, and D.H. Swan, "The Darrieus Hydraulic Turbine - Model and Field Experiments", 4th ASME International Symposium for Hydro Power and Fluid Machinery, San Francisco, CA, Dec. 1986.
10. Farrell J.R., B.V. Davis, D.H. Swan, and K.J. Jeffers, "Generation of Electrical Power from the Florida Current of the Gulf Stream", Presented at the 18th Offshore Technology Conference, Houston Texas, May 5-8, 1986.
11. Swan D.H. and Davis B.V. "The Canadian Vertical Axis Hydro Turbine Program", Energy Developments, Edited by F.A. Curtis, Pergamon Press, 1984.

12. Swan D.H. and Davis B.V. "Research and Development to Optimize a VAHT Rotor and Draft Tube", Report to the National Research Council of Canada, 1984.
13. Swan D.H. and Davis B.V. "Vertical Axis Turbine in the Saint Lawrence Seaway", Modern Power Systems, 1984.
14. Davis B.V. and Swan D.H. "The Vertical Axis Hydro Turbine" Proceedings of the Bedford Institute Conference on Ocean Energy, Halifax, Canada, Sept. 1983.

Applied Electrochemistry

1. Swan D.H., B. Dickinson, M. Arikara,, M. Prabhu, "Construction and Performance of a High Voltage Zinc Bromine Battery", Proceedings of the Tenth Annual Battery Conference, Published by IEEE, California State University, Long Beach, CA, January 11, 1995.
2. Swan D.H., B. Dickinson, M. Arikara, M. Prabhu,"Fuel Cell Dynamics in Transit Applications" Proceedings of the 12th International Electric Vehicle Symposium, Volume 1, pages 73-80, Dec. 1994.
3. Swan D.H., M. Arikara, B. Dickinson, M. Prabhu, "Cathode Air Control of a PEM Fuel Cell Stack Operating on the USABC Dynamic Stress Test", Proceedings of the 1994 Fuel Cell Seminar, pages 217 to 220.
4. Swan D.H., B. Dickinson, M. Arikara, "Proton Exchange Membrane Fuel Cell Characterization for Electric Vehicle Applications", Society of Automotive Engineers, SAE Paper #940296, Appears in SAE Special Publication SP-1023 "Advancements in Electric and Hybrid Electric Vehicle Technology", 1994.
5. Swan D.H., B. Dickinson, M. Arikara, G.S. Tomazic, "Demonstration of a Zinc Bromine Battery in an Electric Vehicle", Proceedings of the Ninth Annual Battery Conference, California State University, Long Beach, CA, pages 104-109, January 1994, Also published in IEEE Systems magazine, Volume 9, Number 5, pages 20-23, May 1994.
6. Deluchi M., D.H. Swan, "The Promise of Fuel-Cell Vehicles", Access Magazine, Number 3, Fall 1993.
7. Swan D.H., M. Arikara, A.D. Patton, "Modeling Car Batteries with Neural Networks", Machine Design, Volume 65, Number 21, pages 133-134, October 22, 1993.
8. Swan D.H., M. Arikara, A.D. Patton, "Battery Modeling for Electric Vehicles Applications Using Neural Networks", Society of Automotive Engineers, SAE Paper #931009, Appears in SAE Special Publication SP-969 "Electric and Hybrid Vehicle Advancements", pages 89-97, 1993.
9. Dickinson B. E., D.H. Swan, T.R. Lalk, "Comparison of Advanced Battery Technologies for Electric Vehicles", SAE Paper #931789, SAE Publication SP-984 "Electric Vehicle Power Systems", pages 1-12, 1993.
10. Lee J.H., D.H. Swan T.R. Lalk , "A Spreadsheet Model for Air Fuel Cell Stacks", SAE Paper #931815, SAE Publication SP-984, page 89-97, "Electric Vehicle Power Systems", 1993.
11. Johnson M., D.H. Swan, "Performance Characteristics of an Electrochemically Powered Turboprop: A Comparison with State of the Art Gas Turbines", Proceedings of the Fifteenth National Industrial Energy Technology Conference, Houston TX, March, 1993.
12. Swan D.H., O.A. Velev, S. S. Srinivasan, A.J. Appleby, "Catalyst Utilization and System Efficiency Evaluation of Proton Exchange Membrane Fuel Cells", Proceeding of The Electrochemical Society 182 meeting, October, 1992.
13. Swan D.H., A.J. Appleby, "Fuel Cells and Other Long Range Technology Options for Electric Vehicles, Knowledge Gaps and Development Priorities", Proceedings of The Urban Electric Vehicle, Stockholm Sweden, pp 457-468, May 1992.
14. Swan D.H., O.A. Velev, S. S. Srinivasan, A.J. Appleby, "Fuel Cell Platinum Utilization", Proceedings of the National Hydrogen Association, 3rd Annual U.S. Hydrogen Meeting, Wash, D.C. March 1992.
15. Swan D.H., O.A. Velev, I.J. Kakwan, A.C. Ferreria, S. Srinivasan, A.J. Appleby, "The Proton Exchange Membrane Fuel Cell - A Strong Candidate as A Power Source for Electric Vehicles", Hydrogen 91 Technical Proceedings, International Association for Hydrogen Energy, 1991.
16. Swan D.H., "Fuel Cell Powered Electric Vehicles", Society of Automotive Engineers, SAE Paper #891724, SAE Publication SP-793 "Recent Advances in Electric Vehicle Technology", 1989.

17. S. Srinivasan, D.H. Swan, H. Koch, D.J. Manko, M. Enayetullah and A.J. Appleby, "A Design Study Of High Power Density Solid Polymer Electrolyte Fuel Cells", Proceedings of the Symposium on Fuel Cells, San Francisco, California, Nov. 6-7,1989.
18. Srinivasan S., M. Enayetullah, S. Somasundaram, D. Swan, H. Koch, D. Manko, and A.J. Appleby, "Recent Advances in Solid Polymer Electrolyte Fuel Cell Technology with Low Platinum Loading Electrodes", IEEE J P1623-1629, 1989.

Zero Emission Vehicles

1. Swan D.H. and M.C. Johnson, "Payload Capacity of Advanced Vehicles: A Comparison of Four Propulsion Systems", Proceedings of Solar and Electric Vehicle Conference, Boston, MA, Oct., 1992.
3. Swan D.H., "Hydrogen as a Transport Fuel" Proceedings of the New Fuels Report Conference on New Fuels and Vehicles for Cleaner Air, Phoenix, Arizona, February 1992.
4. Swan D.H., "Overview of Vehicle Hydrogen Storage Options", Proceedings of the National Hydrogen Association, 3rd Annual U.S. Hydrogen Meeting, Washington, D.C. March 1992.
5. Swan D.H., ""Zero Emission Propulsion Systems" Transportation 2000 paper, presented at the Innovative Land Transportation in the 21st Century Conference at Snowmass, CO, October 1991.
6. Swan D.H., "Advanced Propulsion Systems", Proceedings of the National Hydrogen Association, 2nd Annual U.S. Hydrogen Meeting, Washington, D.C. March 1991.
7. Swan D.H., "Electric Vehicle Technology", Energy Foundation Paper, Presented at the Automobiles and their Alternatives, Conference, Boston, MA, January 1991.

