

David H. Swan

Summary: Seventeen years of professional research and development experience in energy conversion and storage systems. Specializing in the design and application of battery, fuel cell and hydrogen technology for automotive and aerospace. Committed to the advancement of efficient and clean energy conversion and storage devices.

EDUCATION

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

EXPERIENCE

2004 - 2005	<u>President</u> , DHS Engineering Inc. Halifax , Nova Scotia. Responsible for Engineering Research and Development Services. Specializing in Hybrid, Electric Vehicle and Hydrogen Development Programs.
2001 - 2003	<u>President</u> , EnergyCS Inc. Monrovia California, Responsible for Engineering and Business Development. Specializing in Hybrid, Electric Vehicle and Hydrogen Development Programs.
1995 - 2000	<u>Senior Manager</u> , AeroVironment, Inc. Monrovia California, Responsible for all energy storage activities at AeroVironment. The Energy Storage Systems Group developed and tested complete battery systems for electric and hybrid vehicles. Development of fuel cell and hydrogen 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	<u>Assistant Director</u> , Institute of Transportation Studies, University of California, Davis. Responsible for the Fuel Cell and Battery Engineering Laboratory and research activities. Taught courses in applied electrochemistry and supervised graduate students.
1987 - 1992	<u>Assistant Director</u> , Center for Electrochemical Systems and Hydrogen Research, Texas A&M University, College Station. Initiated and coordinated electric and hydrogen vehicle research and development programs. These programs included advanced power systems research in fuel cells and zinc bromine batteries. Established the South Central Electric Vehicle Consortium (14 industrial members). Worked directly for Drs. Appleby and Bockris.

NON CONFIDENTIAL PROFESSIONAL POSITIONS HELD

<u>Director</u>	Cumberland Windfields Inc.
<u>Technical Committee Member</u>	Partnership for New Generation Vehicle
<u>Technical Committee Member</u>	Ballard Power Systems
<u>Executive Director</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

- Member of Society of Automotive Engineers
- Member of American Society of Mechanical Engineers
- Professional Engineer - 1985

OTHER PROFESSIONAL ACTIVITIES

- Judge for LA County Science Fair (2003)
- Tour de Sol, (May 2000 Winner of Production Class using personal EV1)
- World Land Speed Record for Electric Vehicles (Oct. 1999, FIA Certified 245 MPH)
- The Grove Fuel Cell Symposium (London 1999, Presentation Winner)
- SAE Congress – Electric Vehicle Session Organizer 1997, 1998, 1999
- Taught a Professional Fuel Cell Short Course for the Electrochemical Society 1997
- APS Electric Road Race - Winner of the Super Stock division 1995, 96, 97
- Organized and directed four university student electric vehicle race teams (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 SAE Fuel Cells for Transportation Conference (Nov. 1991).

PATENTS

- U.S. Patent No. 5,856,037, issued January 5, 1999, entitled “Battery Venting System and Method.”
- U.S. Patent No. 6,682,841, issued January 27, 2004, entitled “Thermal Management for a Vehicle Mounted Fuel Cell System.”
- Four other Patents Submitted/Pending .in the areas of Hybrid Battery Design, hydrogen refueling and Electric Drive.

PUBLICATIONS AND PAPERS**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 to 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. Velez, 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. Velez, 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. Velez, 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. S. Srinivasan, M. Enayetullah, S. Somasundaram D.H. Swan, H. Koch, D.J. 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., 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.
2. 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.
3. Swan D.H., "Overview of Vehicle Hydrogen Storage Options", Proceeding of the National Hydrogen Association, 3rd Annual U.S. Hydrogen Meeting, Washington, D.C. March 1992.
4. 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.
5. Swan D.H., "Advanced Propulsion Systems", Proceeding of the National Hydrogen Association, 2nd Annual U.S. Hydrogen Meeting, Washington, D.C. March 1991.
6. Swan D.H., "Electric Vehicle Technology", Energy Foundation Paper, Presented at the Automobiles and their Alternatives, Conference, Boston, Massachusetts, January 1991.

Fluid Mechanics/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, 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.
3. 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).
4. 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).
5. 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, Institutur Superior Tenneco, Mech. Eng. Dept. 1096 Lisbon, Portugal, (1988).
6. D.H. Swan, G.L. Morrison and G.B. Tatter son, "3-D LDA Study of a Rectangular Jet", AIAA Paper No. 88-0183, (1988).
7. G.L. Morrison, D.H. Swan and G.B. Tatter son, "Rectangular Subsonic Jet Flow Field Study", AIAA Paper No. 87-2732, (1988).
8. 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, Calif. Dec. 1986.
9. 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.
10. Swan D.H. and Davis B.V. "The Canadian Vertical Axis Hydro Turbine Program", Energy Developments, Edited by F.A. Curtis, Pergamon Press, 1984.
11. 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.
12. Swan D.H. and Davis B.V. "Vertical Axis Turbine in the Saint Lawrence Seaway", Modern Power Systems, 1984.
13. 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.
14. Davis B.V. and Swan D.H. "Design Study of Energy Efficient Greenhouses for Intensive Horticultural Production", Report to Agriculture Canada, 1981.