Biographic: **Joseph B. Seale**
98 Day Road
Gorham, ME 04038
tel: 207-839-8637; fax: 207-839-6095; jseale@maine.rr.com

Born: Dallas, Texas, 1945
Harvard College, AB, Physics, 1968
Married, three children.

College concentrations: classical physics, physical chemistry, fluid dynamics, applied mathematics, computer simulation.

Areas of professional concentration (roughly reverse chronological order):

- Dynamic control of electric engine valves (Magnesense LLC, patent pending)
- Thermo-acoustic design (patent pending)
- Small Engine Valve, Mechanical & Electromagnetic Design (Magnesense)
- Maglev transportation design (patent pending)
- Statistical mechanics: theory & computation method models stress relaxation in polymers, rubber, non-Newtonian fluids (1 U.S. patent)
- High performance spring for electric engine valves (1 U.S. patent)
- Magnetic levitation: position & aim ultrasound beam (Nicolet, 3 U.S. patents)
- Dynamic fluid flow control in medical infusion (FluidSense Corp., 1 U.S. patent)
- Acoustic measurement of fluid volume (DEKA R&D Corp.; 4 U.S. patents)
- Measure fluid volume using fluid-coupled resonant disk (FluidSense, 1 U.S. patent)
- Fluid pumping using audio frequency vibrations (P.D. Coop Inc., 1 U.S. patent)
- Fluid dynamics (modeling arterial dynamics; medical infusion device design)
- Ultrasound acoustics (monitoring arterial dynamics)
- Vibrations in mechanical systems coupled to fluids (arteries, the eye)
  (Above 3 items used in research to monitor blood pressure under Critikon, Inc., & to monitor intraocular pressure under a U.S. SBIR grant; 2 U.S. patents)
- Wind powered refrigeration (New Alchemy Institute, 1 U.S. patent)
- Dynamic thermal performance in solar architecture (New Alchemy Institute)
- Wind energy system simulation (New Alchemy Institute & U.S. Dept. of Energy)
- Hydraulics (hydraulic wind energy conversion system, New Alchemy Institute)
- Aerodynamics (wind energy conversion systems, hang gliders, race cars)
- Audio electronics, aural perception (noise reduction, DBX Corp.; 1 U.S. patent)
- Video electronics (projection TV color receiver, Advent Corp.)
- Aircraft aeromechanics (computer simulation team, Bell Helicopter)

Most recent professional work:

Co-founder, Magnesense LLC, developing electromagnetic cylinder valves for camless internal combustion engines: mechanical design (spring patent), electromagnetic structure design (lamination structure patent), computer servo control method (patent pending). Completed venture with SBE, LLC under SBIR grant from U.S. DOE, concentrating on low-pollution small engines.

Most significant accomplishments:

Continuing development of a theory, computation model, and method for materials testing and characterization (U.S. patent 6,631,647) of viscoelastic stress, strain, and creep in solids, including plastics and rubber. Rooted in statistical mechanics, the theory and software prescribe a set of mechanical tests whereby properties of a sample are reduced to about six numeric parameters. In dynamic and FEA simulations, these parameters predict temperature-dependent and time-dependent stress, strain, and failure. The parameters indicate statistical properties: the strengths and groupings of molecular bonds that are broken and rearranged (reversibly and irreversibly) by the combined effects of thermal agitation and stress. The incipient theory was used in simulation and design (1992) of an elastomer-driven intravenous infusion system for IMED Corporation, the ReadyMED. The theory appears applicable to biological tissues such as artery linings, tendons, skin, and the lens and cornea of the eye.

Co-founder of FluidSense Corporation, which contracted to provide, operate, and maintain hospital intravenous infusion systems, including software to minimize medication error. The company failed in late 2001 after its system saw 200,000 patient-days of infusion therapy. A patented (U.S., 5,624,409) control approach by Seale gave, in a single pump, an infusion rate range from 0.1 to 1000 ml/hour, replacing several specialty pumps. Three disposable designs fitting the same pump were used for neonatal, PCA, and general purpose infusions. The small, efficient, lightweight pump operated entirely from a rechargeable battery. This “smart” battery received patient and drug data for the coming infusion, including allowable dosages and adverse drug combinations. The programmed battery pack was reliably matched with the drug container, the patient, and a list of authorized medical personnel. Infrared communications among pumps identified unsafe drug combinations. The pump quantified in-line air bubbles, minimizing “nuisance” alarms when non-harmful small bubbles passed through.

Authored paper (1983, American Solar Energy Society: “Optimum Gases for Transparent Insulation”) that reversed the emerging industry practice of using high molecular-weight gases sealed between window panes. The paper showed that the low thermal conductivity of these gases was more than offset by high thermal convection in a vertical window space. Optimum window insulation could be obtained only with high-atomic-weight noble gases: Argon, Krypton, and Xenon. Worldwide glazing manufacture now relies on noble gas insulation.

Professional Experience:

1997, 2004 – research into maglev transportation (patent pending, 2004)

2002- , founding partner of SBE LLC
- Continuing work following EPA SBIR contract to develop a low-polluting small engine using camless, electromagnetically controlled cylinder valves.

2000- , cofounder of Magnesense LLC, developer of camless electric valves.

1996- , cofounder of FluidSense Corp., developing medical infusion system in R&D venture with P.D. Coop, Inc.

1991- , cofounder of P.D. Coop, Inc.
- Developed the technologies leading to the founding of FluidSense Corp. and to U.S. Patents 5,533,381 and 5,624,409.
- Developed Sonic Pump™ technology (U.S. Patent 5,769,608) using vibrations up to the low kilohertz range to pump liquids with fast start/stop, wide rate range, and tight volumetric servo control.
- Consult for UroMed Corp. for measurement of mass of prostate gland by dynamic vibration method, applying principles described in Seale's U.S. Patent 4,771,792 (see reissue patent RE34,663.)
- Ultrasound Beam Alignment Servo for Nicolet/EME: a magnetically levitated ultrasound transducer translates and rotates to align an ultrasound beam for transcranial monitoring of blood flow (U.S. Patents 5,844,140 & 6,131,459.)

1991, consult for DEKA R&D Corp. Developed phaselock loop controller and improved electroacoustic design for system to measure liquid volume, based on acoustic determination of air volume above fluid diaphragm using a Helmholtz resonator. Named in U.S. Patents 5,575,310, 5,533,389, 5,526,844, 5,349,852.

1990, consult for joint venture, IMED Corp. and DEKA R&D Corp. For the ReadyMED™ elastomeric ambulatory medical infusion device, designed a pre-stressed balloon to deliver fluid at nearly constant pressure from full to empty.

1989-90, independent experimental development of through-the-eyelid intraocular pressure measurement system. Developed theoretical model of vibrations in pressurized elastic spheres. Developed instrumentation for vibrational impedance measurements in test spheres and in the eye. Validated model empirically in pressurized rubber spheres, but showed that geometric variability and damping effects in the eye precluded useful accuracy.

Selected early work:

1984: Compared conductive, convective and radiative heat transport through glazings as function of geometry, materials, infrared-reflection & sealed-in insulating gases: theoretically, in laboratory tests, & in a full-scale greenhouse. Showed why high-molecular-weight gases, having very low thermal conductivity and optimum properties for insulating foams, give high convective heat transport in larger spaces, making them inferior to air in glazings. Showed that heavy noble gases are the best choice for glazings. Publications and a conference presentation spurred industry-wide use of argon and xenon in permanently sealed glazings. New Alchemy Institute, in contract with E.I. duPont, Wilmington, DE.

1984: Designed, with computer simulation, an all-mechanical switching regulator for dynamic load matching between a wind turbine and a reciprocating water pump. The system used turbine rotational inertia for energy storage, choosing whether to engage the pump for each working stroke based on acceleration of the reciprocating shaft at bottom-dead-center. For retrofit to waterpumping windmills in developing countries, this design could double the pump output.

1981-83: Developed and empirically verified a computer model to predict seasonal energy output from a wind energy conversion system of arbitrary configuration. Wrote designer's manual for optimum matching of wind turbines and loads, taking into account average power output, output variability over time, peak design loads, and the economics involving these variables – see references. NAI contract with Rockwell International Corp., Boulder, CO, under grant from U.S. Dept. of Energy.

1980-82: Designed electronically-controlled pneumatic switching regulator for dynamic load matching between a wind-driven or water-driven turbine and a reciprocating compressor, for efficiency optimization under variable operating conditions. Typical application in wind-driven heat pump. Work was begun under NAI employment, completed from personal resources. U.S. Patent 4,441,872.

1976 Private Consultation to Sky Sports, Inc., Milford, NH: Assisted in design of competition-winning hang glider, including development of computer simulation model for performance optimization.

1975-76 Audio R&D Engineer, DBX, Inc., Waltham, MA: Developed non-linear analog filter for fast audio compression/expansion with minimum distortion. Design was put into several DBX compander and noise reduction products. Named in U.S. Patent 4,445,053, “Square law charger.” Also: Designed prototype audio disc scratch suppression circuit.

1973-76 Developed mathematical models for bird flight dynamics in two areas:
1) Propulsion by Flapping. Quantified aerodynamic propulsion and loss mechanisms of flapping (carrying mathematical airscrew and vortex sheet theory into the realm of oscillating, torsionally-compliant airfoils). Developed optimization analysis for flapping

angle, frequency, and aeroelastic pitch-change with flapping motion. Showed that optimization results were consistent with the measured anatomy and videotaped flight motions of the Black Backed Gull.
2) Lateral Stability of Torsionally Compliant Polyhedral Wing. Showed that the polyhedral shape of many bird wings (sloping up and swept forward near the root, sloping down and swept back near the tip), in conjunction with the torsional characteristics of the wing (how easily it twists in response to aerodynamic forces), provides stability superior to the aircraft combination of a straight rigid wing and a vertical stabilizer.

1973-75 Video R&D Engineer, Advent Corp., Cambridge, MA: Designed and developed the video signal processing circuitry for the first volume-production projection color TV, the Model 1000A. This circuitry was the first to provide a no-shortcuts decoding of the NTSC-standard encoding required of all U.S. commercial TV transmitters by FCC regulation since the 1940s.

1972, for Jan Adkins, race car driver, Milford, NH: Designed an airfoil to hold down the rear end of a Formula 4 racecar for added traction, using wingtip baffles to capture low-pressure air between the rear wheels of the car. This design was quickly copied and within four years was a worldwide standard for formula racers. To this day, this baffle design is “standard” on Formula 1 and Formula 4 racecars.

1966, Bell Helicopter, Hurst, TX, with group developing computer dynamic simulations of tilt-rotor aircraft. This group’s pioneering work culminated in the Boeing V-22 Osprey, an aircraft capable of helicopter-style vertical takeoff, high payloads, and long-range high-speed horizontal flight in fixed-wing aircraft mode.

1965, in college: Designed & built electrostatic headphones for personal use, pre-dating the first commercial electrostatic headphones to be introduced by KOSS.

KEY REFERENCES

Single-winding dual-latching valve actuation solenoid, U.S. Patent #6,724,606, Seale, J. & Bergstrom, G., 4/20/2004

System and method for quantifying material properties, U.S. Patent #6,631,647, Seale, J., 10/14/2003

Flat Lamination Solenoid, U.S. Patent #6,550,745, Bergstrom, G. and Seale, J., 4/22/03

Spring for valve control in engines, U.S. Patent #6,341,767, Seale, J. & Bergstrom, G., 1/29/2002

System and method for servo control of nonlinear electromagnetic actuators, U.S. Patent #6,208,497, Seale, J., 3/27/2001

Linearized Ultrasound Beam Alignment Servo, U.S. Patent #6,131,459, Seale, J. & Bergstrom, G., 10/17/2000

Ultrasound Beam Alignment Servo, U.S. Patent #5,844,140, Seale, J. & Bergstrom, G., 12/12/1998

Bearingless Ultrasound-Sweep Rotor, U.S. Patent #5,635,784, Seale, J., 6/3/1997.

Resonant System to Pump Liquids, Measure Volume, and Detect Bubbles, U.S. Patent 5,769,608, Seale, J., 6/23/1998.

Variable-Pulse Dynamic Fluid Flow Controller, U.S. Patent #5,624,409, Seale, J, 4/29/1997.

Conversion of Liquid Volume, Density, and Viscosity to Frequency Signals, U.S. Patent #5,533,381, reissued as RE34,663, Seale, J., 7/9/1996.

Non-Invasive Determination of Pressure in the Body, U.S. Patent # 4,771,792, Seale, J., 9/20/1988.

Non-Invasive Determination of Mechanical Characteristics in the Body, U.S. Patent # 4,646,754, Seale, J., 3/3/1987; also, Australian Patent # 573,080, 10/31/1988.

Square Law Charger U.S. Patent 4,445,053, Jaeger, R. & Seale, J., 4/24/1984.

"A Load-Regulating Clutch for a Water-Pumping Windmill", Seale, J., Fall 1984, New Alchemy Inst. Quarterly #17.

Fluid Energy Conversion System, U.S. Pat. #4,441,872, Seale, J., 4/10/1984.

Matching Wind Turbine Rotors and Loads -- Computational Methods for Designers, Seale, J., April, 1983, RFP-3423, with The New Alchemy Inst. for Rockwell International Corp., 180 pp., National Technical Information Service.

"Adaptive Wind-Powered Compressors for Icemaking and Heating", Seale, J., Winter 1983, New Alchemy Inst. Quarterly, #14.

"Optimum Gases for Transparent Insulation", Seale, J., 1983, in Energy Conserving Solar Heated Greenhouses: Horticulture and Technology Working Together, John Hayes, Alex Wilson, eds., American Solar Energy Soc., Inc.

"Relative Properties of Insulating Gases", Seale, J., Winter 1981/82, New Alchemy Inst. Quarterly, #7.

"An Integrated Wind Powered System to Pump, Store and Deliver Heat and Cold", Seale, J., 1980, J. of the New Alchemists, #6.