

Michael Charles Vogt, Ph.D.

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Career Goals

Research Scientist/Computer Engineer/Educator. The goal of my career has been to address and resolve difficult scientific and engineering problems in government, commercial industry, and defense, through practical, innovative, and simply clever application of advanced computation techniques, systems modeling, and instrumentation development. I have specialized in applied artificial intelligence, and advanced sensor design coupled to automated platform deployment.

Educational Background

Ph.D.	Computer Science, Illinois Institute of Technology, IL
M.S.	Computer Science, Illinois Institute of Technology, IL
B.S.	Engineering Physics, Bemidji State University, MN

Professional Experience

Developing a professional research career requires dedication and a significant commitment of education and experience - I have gained both at Argonne National Laboratory (ANL, located outside of Chicago, IL), and by working directly for private companies to apply those skills in commercial applications. Argonne is the initial and largest of the U.S. Department Of Energy (DOE)/Department of Defense (DoD) National Laboratories, with almost 5,000 researchers and support staff in over 30 specialized research divisions. These divisions investigate multidisciplinary topics from basic particle physics and chemistry to computational science and energy systems. I completed all of my graduate studies while working full time with both basic and applied research divisions at Argonne. This complemented my already cross-cutting technical education with practical experience in several different fields from material science to natural systems modeling to robotics to medicine. From my start at the national labs, I learned to recognize new research opportunities and propose and develop new research programs. Over my 20+ year tenure at Argonne I have been responsible for proposing and being awarded over \$21M in research funds (in 1990's dollars), and have received awards for outstanding performance including an R&D100 award in 2002. I maintained a DOE 'Q' (Top Secret) security clearance for all of my military and homeland defense projects.

During my years at ANL I also consulted professionally. The DOE/DoD encouraged senior staff to consult professionally outside of their government R&D projects, with the purpose to exchange expertise and stay aware of the "real world" needs. My consulting efforts, along with my experience at ANL, led me to commercialize technologies from the DOE/DoD to industry through the U.S. federal Small Business Innovation Research (SBIR) program. In the past three years, I have proposed and been awarded (12) SBIR Phase I project and (3) SBIR Phase II projects. Four of these projects involve designing and developing experimental medical sensing instrumentation for the Air Force and National Institute of Health.

I have worked in *specialized expert systems development* for over 15 years, engineering a variety of tailored systems for U.S. defense needs, and U.S. commercial applications in both small business and

multi-division corporate environments. Much of my DOE/DoD research and several of my SBIR/STTR projects included or focused on expert system development. In the past year I have concentrated my consulting work on this important and practicable application of computer-based artificial intelligence.

1988 - 2009 - Present Independent Consulting Scientist
Vogtland Innovations and Research, Ltd.

As a private consultant I provide support for a variety of technologies including advanced chemical sensing and instrumentation, computational modeling, and expert system development and integration. The support includes instruction, experimental planning, and instrumentation electronics design with integrated control software and communications. I have developed and managed a professional team to provide cost-effective specialized software development and computer information systems for corporate clients. Software systems include large scale systems modeling and complete life cycle software engineering embedding artificial intelligence-based decision support into predictive models.

U.S. industry and defense sponsors needed specialized support for new advanced sensor technologies. I initiated a new independent consulting effort to support the development and commercialization of new special-purpose electronic sensors. I have developed new sensors to monitor for leaks in hazardous liquid tanks at power plants, and I designed detailed new commercial manufacturing processes for both liquid and gas sensors including ceramic-metallic (cermet) gas-phase voltammetric sensors. I developed micro-miniature support circuitry for experimental electronic nose applications, and worked with commercial vendors for complete fabrication, population, and testing of the printed circuit boards. I have designed new retro-fit-able modular apparatus to improve the sensitivity of existing commercial chemical analyzers, and to enable the detection of biological materials. I have introduced new sensors with advanced behaviors and controls to miniature robotic and remote operated (ground and aerial) deployment platforms. All of my independent sensor research has helped enable the U.S. agencies and provide technical support for challenging problems.

Large industry and small businesses both need private consulting that can address their specialized needs for expert system software development and advanced computer modeling, and to provide assistance in transferring advanced DOE and DoD technologies to the private sector for commercialization. I have focused special effort on the development of expert systems and computational models for commercial and industrial businesses. This work involves designing and implementing tailored solutions using commercial software development environments including Exsys Corvid™, MathWorks MATLAB™, UTS's TKSolver™, and Wolfram's Mathematica™. This is a departure from direct sensor and automation engineering research, and concentrates on a recognized industry need for applying artificial intelligence to controls and decision support to improve efficiency and preserve departmental knowledge.

2005-2009 Principal Investigator and Project Engineer (and Partner)
Streamline Automation, LLC, Huntsville, AL

With endorsement and support from the DOE, I became a technology transfer liaison working with Streamline Automation LLC (SA - a commercial small business) to refine and commercialize several technologies SA had licensed from the DOE. I continued to employ and improve my engineering skills, with a focus on adapting experimental technologies towards industrial and military applications with 'product development' as a primary goal. With SA, I have secured over (10) Small Business Innovation Research (SBIR) and Small business Technology Transfer (STTR) programs to develop sensors and

capabilities, including ISO-9002 and U.S. Army certification for chemical agents. I designed and built complex hybrid cermet circuits, microelectronics, and computer instrumentation for sensor operation and evaluation. I have guided the microsensor program from conception through commercial fabrication to full military field demonstrations. I have integrated the pattern recognition and signature analysis techniques I had developed into an advanced computer-aided software [algorithm] engineering (CASE) environment – the *Sensor Algorithm Generation Environment (SAGE)* - using MathWorks MATLAB [as my Ph.D. dissertation topic]. SAGE is built upon a novel genetic optimization engine selecting algorithm components and serves as an expert system for integrating and analyzing multi-sensor array data allowing automated and semi-automated classification of responses from MS, GC, AA, IRS, FTIR, and IMS, as well as multi-spectral, and hyper-spectral imagery from a wide variety of stationary, portable, and space-based sources. As a member of a larger team, I have combined my chemical sensing, Geographic Information Systems (GIS), Supervisory Control And Data Acquisition (SCADA), engineering, and artificial intelligence (AI) backgrounds, to design emergency and crisis management systems for international industry and the U.S. military, and I have applied advanced sensor controls from my research toward adaptive robotics and intelligent system controls. *The sensor technologies I have developed have been patented, and both systems and support technologies are being adopted by industry and military sponsors to solve current and predicted problems. In 2002, my research on Intelligent Fire Detection earned an international “R&D100 Award” for excellence and technical innovation.*

May 1984 - 2005 Research Scientist, Applied Computer Science
Energy Systems Division, Argonne National Laboratory

*U.S. industry and U.S. military require new land management capabilities and improved methods for analyzing data and managing information to support those capabilities. As a computer scientist for the Land Resources Analysis Program, I develop dedicated special-purpose information management tools (databases with embedded expert systems and AI-based optimization) to provide decision support and optimized site management for U.S. military bases and American industrial sites. I have worked on developing two complete Digital Libraries for the National Science Foundation (NSF) National Science Digital Library (NSDL) effort. These included topics for Atmospheric Visualization Library and the Digital Archaeological Excavation (DAE). Both projects involved digitizing and managing a variety of data forms, then coding applications and lesson plans to help educators use the digitized instrument data, imagery, CAD files, maps, and databases as aids to teaching both secondary and college-level courses. I have developed and employed advanced [neural network and wavelet] data mining techniques to predict natural resource locations and archaeologically-significant sites for the mining and oil industries. I have written and integrated original complex genetic optimization and Markov prediction numerical models into Geographic Information Systems (GIS) applications for enhanced simulation of natural [environment – species, landfill operations, gas dispersion, etc.] systems used as a Decision Support System for the U.S. Army base commanders. I executed these models on a range of ultra-high-performance computer systems, including scalable massively parallel systems including a Cray Y-MP M90 vector computer, iPSC/2 hypercube, Sequent Symmetry, and IBM SP-2. The operating systems includes libraries such as LINPACK, Linda, MPI, and MPS. I also developed models for smaller PVM3 and Beowulf Parallel Clusters, as well as heterogeneous clusters running the Globus Toolkit for Grid Computing. I have used computer-aided design (CAD) and GIS applications to develop spatial models to enhance resource visualization and interpretation of abstract data; this included advanced neural image processing expert system to classify military airborne photographs. I have designed and developed commercial software, including applications for GIS/Global Positioning System (GPS) mapping and fleet management. *The capabilities I have developed for ANL’s GIS groups have allowed larger and more complicated problems to be investigated with existing capabilities. This has led to reduced costs and improved results.**

June 1989-2005 Scientific Computing and Information Systems Manager
Energy Systems Division, Argonne National Laboratory

Argonne National Laboratory's largest division, Energy Systems (ES), required a systems manager who could address the past, current, and future needs of the division and develop both operations and scientific computing capabilities. As Scientific Computing Systems Manager, I planned and managed the division's operations and scientific computing capabilities including hardware, software, and networking components. I have guided the computing systems through several major infrastructure upgrades, from original mainframes through to wireless remote distributed systems. I designed and administrate a scalable parallel cluster of CPUs to support GIS, expert systems, and scientific modeling efforts, and I have developed web-based portals to support divisional programmatic and administration information needs. I have used the selected tools to design division-specific expert system tools for office and department management, emergency response instruction, and staff member computer security education. I have had specialized training and experience in the theory and use of a range of computer-aided software engineering (CASE) tools, and have written a Software Quality Assurance Policy for the division that includes my training of staff in advanced software engineering methods. I have also received special computer security training, and have participated in ISO-9002 certification and detailed Government Accounting Office (GAO) Computer Security Audits. I have 20 years of experience engineering software using a wide variety of programming languages including: Visual BASIC, Java (IBM VisualAge), C/C++, FORTRAN/77/90/HPF, fourth-generation languages like Mathematica and MATLAB, and many assembly languages. I have 25 years of practical experience working in a variety of operating systems, including MS Windows, UNIX/IRIX/Linux, MacOS, and other special-purpose high performance environments. I routinely design and develop microcontroller and microcomputer-controlled data acquisition systems for various laboratory experiments that require specialty software development. My contributions have helped the ES Division secure more computer-dependent research projects based on these well-developed computing and communication capabilities.

Current Research Interests

My Ph.D. studies focused on applying formal software engineering methodologies toward high-performance scientific programming and automated [sensor] algorithm engineering. I have since directed much of my work toward the design and development of hybrid expert systems, leveraging my experience in algorithm engineering to construct expert systems that can ingest both measurement data and heuristic rules.

Active member of Institute of Electrical and Electronic Engineers (IEEE)

Awards and Honors

- Featured Researcher – *U.S. Presidential (G.W. Bush) Homeland Security Inspection*, Argonne National Laboratory, 2003
- *R&D Magazine's International R&D100 Award* for 100 most significant new technologies - "Smart Sensor Developers Kit", 2002

- *Laboratory Director's Special Award for Outstanding Performance* – Argonne National Laboratory, Chicago, IL, 2001
- Featured Speaker – *International Society for Optical Engineering (SPIE) Intelligent Systems and Smart Manufacturing Conference*, “Neural Network-Based Sensor Signal Accelerator”, Boston, MA, 2000
- Featured Speaker – *International Society for Optical Engineering (SPIE) Intelligent Systems and Smart Manufacturing Conference*, “Sensor Algorithm Generation Environment (SAGE) for Spectral Sensor Support”, Boston, MA, 2000
- Featured Speaker – *International Society for Optical Engineering (SPIE) International Symposium on Chemical Sensors*, “Active Voltammetric Microsensors with Neural Signal Processing”, Boston, MA, 1998
- Featured Speaker - Union Carbide's Annual *Chemical and Physical Measurements Symposium*, “Electrocatalytic Gas Microsensor Technologies”, Charleston, WV, 1997
- Featured Research for Argonne National Laboratory at Technology 2005 Expo, “Intelligent Gas Microsensor”, Chicago, IL, 1995.
- Best Paper Award - *GRASS Technology Development: Eighth Annual GRASS GIS Users' Conference*, “Integrating GRASS with CAD, GPS, and Photographs for Impact Assessment and Simulation”, Reston, VA, 1993.

CV and references available upon request

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Curriculum Vitae for Michael C. Vogt, Ph.D.

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Note – Beginning in the 1990's during the Gulf War and the fall of the former Soviet Union, my defense and homeland security-related R&D publication has been controlled by DoD and DHS. Controlled publications are only available through direct contact with those sponsors and information regarding this can be provided upon request. Non-defense related publications are listed as follows.

Publications: Textbooks

Musiba, C., C. Magori, M. Stoller, T. Stein, S. Branting, M. Vogt, R. Tuttle, B. Hallgrímsson, S. Killindo, F. Mizambwa, F. Ndunguru, and A. Mabulla, 2007, "Taphonomy and paleoecological context of the Upper Laetoli Beds (Localities 8 and 9), Laetoli in Northern Tanzania", in *Hominin Environments in the East African Pliocene: An Assessment of the Faunal Evidence, 1st edition*, edited by René Bobe, Zeresenay Alemseged, and Anna K. Behrensmeyer, ISBN-10: 1402030975, Published by Springer, Dordrecht, The Netherlands, pg 257-279.

Vogt, M.C., and J. Fraden, 2003, "Chemical Sensors" in *Handbook of Modern Sensors, 3rd Ed.*, by Jacob Fraden, American Institute of Physics, Woodbury, NY.

Sydelko, P., M. Vogt, and R. Sundell, 1997, Spatial Decision Support Systems (SDSS): New Directions in the Design and Application for Selecting and Delineating Parks and Reserves, in *National Parks and Protected Areas -- Selection, Delimitation, and Management*, ed. by J. Pigram and R. Sundell, Centre for Water Policy Research, University of New England, Armidale, New South Wales, Australia.

Vogt, Michael C., 2002, *Sensometrics: Sensor Algorithm Engineering*, Ph.D. dissertation and graphical expert system in computer science, Graduate College of the Illinois Institute of Technology, Chicago, Illinois, December.

Publications: Journal Articles

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Skubal, L.R., N.K. Meshkov, and M.C. Vogt, "Detection and Identification of Gaseous Organics Using a TiO₂ Sensor," *Journal of Photochemistry & Photobiology A: Chemistry*, 148 (2002) 103-108.

Vogt, Michael C., 1998, *Lilliputan Sensors Could Help Solve a Gigantic Pollution Problem*, TransForum, Argonne National Laboratory, Argonne, IL, Summer, Vol. 1, No. 3, pp 5.

Shoemaker, E. L., M. C. Vogt, F. J. Dudek, and T. Turner, 1997, *Gas Microsensors Using Cyclic Voltammetry with a Cermet Electrochemical Cell*, *Sensors and Actuators A: Physical*, Elsevier, Sequoia, Netherlands, Vol. 42, Issue 1, July 15, pp. 1-9

Vogt, M. C., P. J. Sydelko, and R. C. Sundell, 1998, *valleydef: An Algorithm for Delineating Discrete Valley Boundaries*, *Ecological Modeling Journal*, in review.

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Vogt, M. C., E. L. Shoemaker, D. A. MacShane, and T. Turner, 1997, *An Integrated-Technologies Gas Microsensor*, Sensors and Actuators B: Chemical, El Sevier, Sequoia, Neatherlands, February, Vol. 36/1-3, pp. 370-376.

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Shoemaker, E. L., M. C. Vogt, and F. J. Dudek, 1996, *Cyclic Voltammetry Applied to an Oxygen Ion Conducting Solid Electrolyte as an Active Electrocatalytic Gas Sensor*, Solid State Ionics, Amsterdam, Neatherlands, Vol. 92, pg 285-292.

Vogt, M., V. Comello, 1996, *Sensor Technology Offers Versatility in Gas Detection*, R&D Magazine, January, pg 53-54

Aldstadt, J., M. Vogt, 1995, *Environmental Monitoring at Argonne National Laboratory*, Environmental Sensors, September, IOP Publishing, Ltd., Bristol, UK, pg 5-8

Vogt, M.C., 1994, *Smart Gas Microsensor*, Popular Science Magazine, November, pg 11.

Vogt, M.C., 1994, *A More Versatile Ceramic/Metallic Gas Sensor*, NASA TechBriefs - Federal Lab Test & Measurement Tech Briefs, Vol 18 No. 11, November, pg 13a.

Sullivan, R. G., and M. Vogt, 1993, *Integration of CAD Graphics and Ground-Level Perspective Photographs with GRASS Imagery*, GRASS Clippings: Journal of Open Geographic Information Systems.

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Publications: Conference Papers

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Vogt, Michael C., 2000, *Neural Network-Based Sensor Signal Accelerator*, SPIE Intelligent Systems and Smart Manufacturing Conference, International Society for Optical Engineering (SPIE), Boston, MA, 5-8 November

Vogt, Michael C., 2000, *Sensor Algorithm Generation Environment (SAGE) for Spectral Sensor Support*, SPIE Environmental and Industrial Sensing Conference, International Society for Optical Engineering (SPIE), Boston, MA, 5-8 November

Skubal, Laura R. and M.C. Vogt, 2000, *A Photocatalytic Gas Microsensor Using Titanium Dioxide*, SPIE Environmental and Industrial Sensing Conference, International Society for Optical Engineering (SPIE), Boston, MA, 5-8 November

Plotnick, Roy E., M.C. Vogt, 1999, *Wavelet Analysis and The Recognition of Hierarchy in Phanerozoic Biodiversity Patterns: The Syllables of Recorded Time Series*, Geological Society of America Annual Meeting, Denver, Colorado, October 24-28, Abstracts published in *GSA Abstracts with Programs*, Geological Society of America, Boulder, Colorado, volume 31, number 7

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Sundell, R.C., P. Sydelko, K. Majerus, J. Keisler, Z. Li, and M. Vogt, 1996, *Using a Dynamic Landscape Analysis and Modeling System to help Manage Parks and Protected Areas*, 23rd Annual Natural Areas Association Conference in conjunction with the Indiana Dunes Ecosystem Conference and the 15th North American Prairie Conference, St. Charles, IL, October 23.

Vogt, M.C., E.L. Shoemaker, T. Turner, 1996, *A Trainable Cermet Gas Microsensor Technology Using Cyclic Voltammetry and Neural Networks*, The 6th International Meeting on Chemical Sensors, National Institute of Standards and Technology, Gaithersburg, MD, papers and oral presentations, July 22-25.

Shoemaker, E.L., M.C. Vogt, T. Turner, 1996, *Thick-film Gas Microsensors Using Cermet Materials, Cyclic Voltammetry, and Neural Networks*, Solid-State Sensor and Actuator Workshop, Hilton Head, SC, paper and oral presentation, June.

Sundell, R.C., C. Loehle, P. Sydelko, J. Burke, M. Vogt, D. Hayes, and K. Majerus, May 22-24, 1995, *Dynamic Landscape Modeling System for Natural Resources Management*, Department of Defense Environmental Technology Workshop, Hershey, Pennsylvania, sponsored by the U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland.

Sundell, R., C. Loehle, P. Sydelko, J. Burke, M. Vogt, and D. Hayes, March 14-18, 1995, *Managing Natural Resources Using GIS and Dynamic Landscape Modeling*, 91st Annual Meeting of the Association of American Geographers, Chicago, Illinois.

Vetrone, J., C. Foster, E. Shoemaker, M. Vogt, 1995, *Fabrication and Properties of Thin Film YSZ Multi-gas Sensor*, Environmental Sensors Symposium, Electrochemical Society Meeting, Chicago, IL, October.

Sydelko, P.J., M. C. Vogt, and T. Williams, 1995, *Right-Of-Way Erosion Evaluation Program (REEP)*, 1995 ASAE Annual International Meeting, Chicago, Illinois, June 18-23.

Bogner, J. E., C. Rose, M. Vogt, and D. Gartman, 1988, *Understanding Landfill Gas Generation and Migration*, Proc. GRCDA 11th International Landfill Gas Symp., Houston, Tex., Governmental Refuse Collection and Disposal Assn., Silver Spring, Maryland, March 21-24.

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Vogt, M.C., 2008, *NO_x Engine Emissions Sensing Using Gas-Phase Voltammetry*, Interim Report for DOE FreedomCAR Program, Document No.: 1024/1041-DOC-01-R0, Streamline Automation, LLC, Huntsville, AL, December.

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Vogt, M.C., 2007, *High-Speed Data Acquisition with Automated Wavelet Analysis for Failure Identification - Supersonic Wind Tunnel Valve Position Indicator*, SBIR special report for U.S. Air Force's Arnold Engineering Development Center (AEDC), Document No.: 1014-DOC-01-R0, Streamline Automation, LLC, Huntsville, AL, November.

Vogt, M.C., M.E. Vogt, and A. Reich, 2006, *Hydro-pneumatic Suspension Unit Charge Prediction and Optimization Graphical Expert System for the Expeditionary Fighting Vehicle*, STTR Phase I final report for U.S. Marine Corp STTR Topic No. N06-T001, Document No.: 1022-DOC-01-R2, Streamline Automation, LLC, Huntsville, AL, October.

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Reich, Alton, and M.C. Vogt, 2005, *Sensor Characterization Test Specification for Continuous Hypergolic Monitor Network for Shipboard Applications*, a Final Report for U.S. Army SBIR Topic MDA04-146, Document No.: 1007-DOC-03-R0, Streamline Automation, LLC, Huntsville, AL, December.

Reich, Alton, and M.C. Vogt, 2005, *Development of a Portable Breath Analysis System Based on a Novel Electronic Nose Microsensor*, a Final Report for U.S. Air Force STTR Topic: AF04-T017, Document No.: 1005-DOC-07-R0, Streamline Automation, LLC, Huntsville, AL, November.

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Zimmerman, R.E., P.L. Wilkey, M.C. Vogt, L.L. Altpeter, J.K. Lee, I.J. Solomon, and R.W. Anderson, 1998, *Feasibility Study For An Intelligent Gas-Pipeline Emergency Management System In Korea*, Final Report, Energy Systems Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, May.

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