Electronic Product Design & Development Consulting Services

P.O. Box 4739   **Cary, NC 27519-4739**   **919 460 0081 Voice/FAX**

BACKGROUND

For over 10 years **E**lectronic **P**roduct **D**esign & **D**evelopment **C**onsulting **S**ervices (**EPDDCS**) has provided product development engineering services to the business community. The services provided have spanned client requirements from the use of a single EE design consultant up to a complete multidiscipline (electrical, electronic, mechanical, & software) team. The personnel for these teams are drawn from local, full-time independent consulting engineers who have successfully worked together on multiple client projects in the past. This type of arrangement provides the client with a virtual in-house product development team but without the effort and financial commitment of finding and hiring experienced engineering specialists.

The **EPDDCS** product development team has considerable embedded microcontroller software development experience both in "C" and assembly. This includes software development for the highly regulated medical industry. **EPDDCS** has exclusively focused its embedded development efforts and expertise on "C" applications on the MSP430, Texas Instruments ultra-low-power, flash based, 16-bit RISC family of microcontrollers. **EPDDCS** has the full "C" software development tool chain for the MSP430 as well as all necessary test equipment.   **EPDDCS** is listed as a 3rd Party Developer on the TI MSP430 website.

Contact **EPDDCS** to see how we can help you reach your product development targets.

EPDDCS

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Electronic **P**roduct **D**esign & **D**evelopment **C**onsulting **S**ervices: Embedded Microcontroller Systems (Hardware & Software) utilizing TI Ultra Low Power MSP430, Mixed Analog and Digital Circuit Design, PCB Design and Layout (Thru Hole & SMT), Fuzzy Logic & Neural Network based Control Systems, Product Design & Development Engineering Services, Medical & Industrial Instrumentation, Temperature Measurement & Control, Signal Processing Algorithms, Test Fixture Design, Low Power, Battery Powered, & Portable Systems, High Resolution & Low Noise Data Acquisition, Transducer Interfacing, Reduced EMI/RFI Emission & Susceptibility, Power Electronics, Proof-of-Concept Prototypes to Final Manufacturable Products, Complete Engineering Documentation & Drawings, Documentation Packages for Contract Assembly, Turn Key Development, and Consulting.

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EPDDCS CAPABILITY LIST

Real-Time Embedded Microcontroller Systems, both Hardware and Software (C & assembly), specializing in the Texas Instrument MSP430 family of Flash based, Ultra Low-Power, 16-bit RISC Microcontrollers
- Medical & industrial instrumentation
- Temperature measurement & control
- Signal processing algorithms
- Test fixture design

Fuzzy Logic & Neural Network based Control Systems
- Difficult systems to model
- Adaptive control

Mixed Analog and Digital Circuit Design
- High resolution, & low noise A to D (data acquisition) systems
- Transducer interfacing
- Low power, single supply, battery powered, and portable systems
- Reduced EMI/RFI emission & susceptibility circuit design
- Power electronics

Printed Circuit Board Design and PCB Layout (thru hole & surface mount)
- Schematic capture
- PCB Layout
- Complete engineering documentation & drawings
- Design for manufacturing
- Design for regulatory standards compliance

Design & Development Engineering Services
- Reverse engineering & competitive analysis
- Cost reduction, performance improvement, new design, or redesign
- Proof-of-concept prototypes to final manufacturable products
- Project management and specification development
- Risk analysis of designs and of particular development approaches
- Turn key development or as a consulting resource

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MURDOCK TAYLOR
Design Consultant
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Engineer, team leader, project manager, engineering manager, and consultant with proven ability to conceive, design, and implement state-of-the-art electronic instruments and industrial equipment. Demonstrated success in all phases of product development, from initial breakthrough technology generation through proof-of-concept prototype to fully documented volume manufacturing.

Proven Results Include:

- Co-developed the technology base for a successful startup medical diagnostics company. Translated core technology into a HW/SW design to meet the extreme reliability demands in this market.

- Project management and project responsibility from initial concept through production and test, including coordination of outside consultants and design vendors, supervising, training, and leading multidiscipline project teams. Developed specifications, evaluated, negotiated with, interfaced, and coordinated contract design, engineering, software, and manufacturing firms.

- Managed software development projects, including developing specifications, for embedded software (C & assembly), PC DOS based software (C), and PC Windows based software (C++).

- Successful technology transfer of a medical diagnostic instrument to several international licensees.

- Set up engineering department for product development and manufacturing support including infrastructure for product development process, part & document numbering, configuration control, documentation control, bills of material, part files, MRP, change notice & change order procedures, incoming inspection, assembly, test, and quality assurance suitable for FDA Good Manufacturing Practices.

- Managed R & D Engineering department, responsible for product development, budget, personnel, product development portion of corporate 5-year strategic plan, engineering infrastructure, and manufacturing support.

Credentials

- Developed optical systems (ultraviolet, visual, & infrared) for medical & industrial instrumentation, temperature measurement & control systems, data acquisition systems, and signal processing algorithms.

- A broad, diversified background of successful electronic/electrical design experience including
  - application specific integrated circuit (ASIC) CMOS VLSI motor control chip,
  - fuzzy logic & neural network based control systems,
  - battery powered medical diagnostic instrumentation,
  - single supply analog circuits,
  - high resolution (20-bit) & low noise A to D circuits,
  - embedded microprocessor hardware & software,

- • digital circuits (CMOS, LSTTL, HCMOS),
- • power electronics and SCR applications in motor starters, motor controls, DC drives, chargers, and step-wave inverters.

- Experienced in compliance with the following standards: Good Manufacturing Practices (GMP), Food & Drug Administration (FDA), Underwriters Laboratories (UL), Canadian Standards Association (CSA), Institute of Electrical & Electronic Engineers (IEEE), National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA) & International Standards Organization (ISO).

- Experienced in designing, implementing, and managing the development of real time embedded microcontroller systems, including both hardware and software (assembly language & C programming) for Texas Instruments Ultra Low-Power MSP430, Microchip PIC, Scenix/Ubicom SX, Motorola (68000 and 68HCXX) and Intel (8048, 8051) microprocessors. High-level language programming capability in C, FORTRAN, and PL/1.

Education

MSEE from N.C. State University, Raleigh, NC (3.4/4.0) 8/23/84 - 5/10/86
Emphasized real time microprocessor control applications.

BSEE with Honors from N.C. State University, Raleigh, NC (3.088/4.0) 8/73 - 12/76

Publications

- Alkadhi ZY, Crowder PF, Ernst PS, Taylor M, and Oberhardt BJ. Convenient Dry Chemistry System for Rapid Fibrinogen Determination (abstract). Thrombosis and Haemostasis 1993. Presented at the XIVth Congress of the International Society on Thrombosis and Haemostasis, New York, New York, 1993.

- Oberhardt BJ, Gresalfi NJ, Enney-O'Mara LA, Bingham WH, Taylor M, and Abruzzini AF. Measurement of Functional Activity of Thrombolytic Drugs Using Lysis Onset Time, a Quantitative Parameter Based on Analysis of Motion of Paramagnetic Particles in a Thrombus (abstract). Thrombosis and Haemostasis 1991; 65(6): 2062a. Presented at the XIIIth Congress of the International Society on Thrombosis and Haemostasis, Amsterdam, Netherlands, 1991.

- Oberhardt BJ, Dermott SC, Taylor M, Alkadhi ZY, Abruzzini AF, Gresalfi NJ. Dry Reagent Technology for Rapid, Convenient Measurements of Blood Coagulation and Fibrinolysis. Clinical Chemistry 1991; 37(4): 520-526.

- Oberhardt BJ, Dermott SC, Taylor M, Alkadhi ZY, Gresalfi NJ. Dry Reagent Technology for Rapid, Convenient Blood Coagulation and Fibrinolysis Measurements (abstract). Fibrinolysis 1990; 4 (suppl. 3): 35.   Presented at the 10th International Congress on Fibrinolysis, Indianapolis, Indiana, USA, August, 1990.

- Oberhardt BJ, Taylor M, Alkadhi ZY, Dermott SC. Diagnostic Assay System for Convenient Monitoring of Oral Anticoagulant Therapy (abstract). Thrombosis and Haemostasis 1989; 62(1): 327. Presented at the XIIth Congress of the International Society on Thrombosis and Haemostasis, Tokyo, Japan, August, 1989.

Employment History

Design Consultant (self-employed consultant) 1/2/95 - present
Electronic Product Design & Development Consulting Services   Cary, NC

Provide a variety of electronic product design and development engineering consulting services to clients. Projects have included embedded system development (HW & SW), circuit design, PCB layout, PCB assembly, prototype fabrication, test fixture development, product design/redesign for manufacturability, trouble shooting/debugging fuzzy logic based controller firmware, engineering documentation, medical instrument design, specification development, research, risk analysis, feasibility studies, PLC software development, identifying and solving intermittent problems with a production electronic assembly, project planning, cost analysis/cost reduction, review/evaluation of contract design & assembly vendor performance, and identification of critical component sources.

<u>Research & Development Engineering Manager</u> 2/14/94 - 12/30/94
Graseby Nutech (division of Graseby Andersen Inc.)   Durham, NC
Responsible for managing R & D Department and for new product development of analytical instrumentation used with GC/MS analysis of air samples. Identified, qualified, negotiated contracts with, interfaced, and managed outside consultants & contractors. Managed PC Windows based software development.   Setting up engineering department capable of in house design and development of instrumentation including hardware, software, and mechanical.   Implementing engineering infrastructure via TQM including configuration control, documentation control, change notice & change order procedures, and product development process. Graseby Nutech was absorbed into its parent company, Graseby Andersen, and operations were transferred to Atlanta in early 1995. I was offered the position of Director of Engineering at Graseby Andersen, but declined due to personal ties to this area at the time.

<u>Product Development Engineer</u> 1/3/87 - 2/11/94
Cardiovascular Diagnostics Inc.   Raleigh, NC
Designed the production version of the TAS Thrombolytic Assessment System. Set up engineering department for product development and instrument manufacturing support including infrastructure for product development process, part & document numbering, configuration control, documentation control, bills of material, part files, MRP, change notice & change order procedures, incoming inspection, assembly, subassembly test, final test, and quality assurance suitable for FDA GMP. Designed prototype versions of COAG-2, a portable medical diagnostic instrument for monitoring thrombolytic therapy. Designed prototype and production ready versions of COAG-1, a portable medical   diagnostic instrument for measuring blood coagulation.   Responsible for developing the documentation package which enabled successful world wide licensing of COAG-1 and for the instrument portion of the technology transfer to the licensees. Managed and lead projects which designed a variety of in-house & production instrumentation, software (embedded and PC based), printed circuit boards, injection molded plastic parts, and data acquisition systems for assay development including coordination of outside consultants and design vendors.   Developed specifications, evaluated, negotiated with, interfaced, and coordinated contract design, engineering, software, and manufacturing firms. Worked on or lead R&D teams developing systems, software, algorithms, and disposables to monitor blood clotting, lysing, fibrinogen, thrombolytic agents, and immunoassay technology.   Co-developer of the diagnostic technology on which Cardiovascular Diagnostics Inc. (a venture capital backed startup) was based. (Cardiovascular Diagnostics Inc. went public in 1996 and is currently known as PharmaNetics Inc.)

<u>Electronic Engineer</u> (self-employed consultant) 11/86 - 12/86
Biotherm Inc.   RTP, NC
Developed instrumentation for medical assay development.

<u>Electronic Engineer</u> (contract) 9/86 - 11/86
Triangle Research and Development Corp.   Raleigh, NC
Developed optical transducer based circuit for medical diagnostic assay development and evaluated the cost effectiveness of writing data acquisition software in 68000 assembly language vs purchasing the software.

<u>Electronics Engineer</u> (part time while in graduate school) 1/15/86 - 3/28/86
OptiChem Technologies, Inc.   Raleigh, NC
Designed signal and optical transducer interfacing circuits along with associated instrumentation.

<u>Engineer/Technician</u> (part time while in graduate school) 6/17/85 - 8/21/85
Triangle MicroSystems, Inc.   Raleigh, NC
Designed 8051 watchdog circuit and battery charging circuit. Tested 8048 based temperature controllers.

<u>Electrical Engineer</u> 9/14/81 - 8/17/84
Electrical South, Inc.   Greensboro, NC
Designed the SUPERSTART line of solid state, reduced voltage, 3 phase, AC motor starters with electronic overload and energy saving circuit in sizes 1Hp through 700Hp at 200V AC through 575V AC. Designed control circuitry, SCR gate firing circuit, and the SCR power circuit. Responsible for all phases of product development from inception to production. Provided applications and product support for customers.   Set up engineering infrastructure for product development and manufacturing support including part & document numbering, configuration control, documentation control, bills of material, part files/drawings, change order procedures, assembly procedures, test procedures, and quality assurance. Designed test fixtures for pc boards and final assemblies, hired and trained test & field service technicians, set up in house pc board manufacturing line including wave solder machine, instituted & trained pc board assemblers & technicians in anti-static electric handling procedures.

<u>Engineer</u> (in Design Engineering) 12/3/77 - 9/11/81
Exide Electronics   Raleigh, NC
Designed circuits, printed circuit boards, power supplies, battery chargers, and transformers. Performed development work on 50Hz, 415Hz, and Hi-eff Uninterruptable Power Supply systems in sizes from 75KVA to 8MVA at 200V AC to 600V AC, involving design, testing, trouble-shooting, and modifying both logic and power portions (SCR applications in step-wave inverters and chargers) in order to achieve design goals. Designed the Master Control Console for an 8 MVA UPS installation.

<u>Junior Field Engineer</u> 1/3/77 - 6/7/77
Schlumberger Well Services   Midland, TX
Performed field service operations and trouble-shooting of oil well logging equipment.

<div align="center"><u>Personal</u></div>

U.S. Citizen, Home Owner, No Dependents, Excellent Health.

<div align="right">September2005</div>