

Executive Overview

Broad hands-on background in the following:

- Product design and development of medical, industrial, scientific, robotic, and consumer products
- Component and system-level electronic circuit design encompassing analog, digital, embedded microcontroller, motor drive, RF, and micropower circuits; low and high frequency PCB design and layout; SPICE simulation
- Electronic and electromechanical sensor design; system and motion control design; robotics
- High volume manufacturing, production, and sustaining engineering; overseas manufacturing and sourcing
- Embedded firmware architecture and design, assembly language coding (8-bit); 8 and 16-bit processors
- Design process and documentation; UL, FCC, and FDA approval requirements and certification processes
- Managing projects, business activities, and negotiations related to electronic design, price / supply negotiations and manufacturing; initial product concept ideation; bringing products from napkin sketch to high volume production

Licensed aircraft mechanic with flight-line experience and a degree in aircraft mechanics and avionics engineering. Affords a unique and solid foundation from which to approach and solve a wide range of electromechanical engineering challenges. **Proven track record of innovation and bringing money making concepts to market.**

Electronic/ Electromechanical Design Experience (major projects / positions)

Owner – Electron Engineering LLC, Brookline, MA

Currently providing electronic circuit and system design, design review, and cost reduction consulting services for several small companies / start-ups in the robotic medical device and consumer electronics space. **(Oct 13 – Present)**

Consulted as a Principal Electrical Engineer for **Medrobotics**, a robotic surgical device start-up. Responsible for electronic and electromechanical system architecture and design, component-level circuit and sensor design, embedded computer architecture design, hands-on prototyping / experimentation, debugging and systems integration for a robotic snake based surgical system. The system will be used to perform minimally invasive throat and cardiac surgery. Other responsibilities included EMC design and mitigation activities, FDA compliant design documentation activities and testing. Within this time period I was also a W-2 employee for one year, March '12 – April '13. **(June 09 – Oct 13)**

Consulted as electronics project manager for **Cue Acoustics**, a consumer electronics start-up that produces a tabletop radio to compete in the same market space as the Bose Wave Radio and similar products. Brought in and managed an external design firm that completed the detailed component-level electronic design. Developed practices and procedures for documentation, revision control, and knowledge capture. Built business relationships with electronic component manufacturers and distributors. Assisted in the design of a system-level ESD protection and EMI mitigation strategy. Worked to place the design into high volume local and overseas manufacturing while working to reduce the BOM costs. **(Mar 07 – Aug 08)**

Lead Electronic Design Engineer, Consumer Robotics Division – iRobot Corp., Burlington, MA

Responsible for system and component-level analog, digital, embedded microcontroller, sensor, and RF design for iRobot's Roomba robotic vacuum product line, as well as several advanced development projects including a robotic lawn mower. Solely responsible from start to finish for the debris sensor, RF communication module, and docking station designs used in the Roomba product line, as well as the microcontroller system architecture for the second generation Roomba. Responsible for extensive high volume component cost savings through aggressive vendor relationship building and business development efforts. Additional responsibilities and experience included:

- Project management involving schedule creation and tracking, budgeting including collaboration with marketing to flush out preliminary COGS and ROI numbers, design technology and approach risk analysis, working with the legal department on initial IP filings, traveling to India when working with and managing the iRobot India design center resources, working with UL and other approval agencies to gain safety and electromagnetic compliance certifications

- Printed circuit board design, layout, and layout management when internal and external resources were utilized
- Taking designs to production including travel to iRobot's contract manufacturers in China to help create, set-up, and debug assembly processes of engineering pilot manufacturing production runs
- Electromechanical design to support sensor development, hands-on prototype building and development
- Low power design for battery operation and battery charger design for NiMH batteries
- Very high electro-static discharge immunity design as the Roomba product is very much like a Van De Graaff generator that requires specialized and unique ESD mitigation strategies

(July 03 – Feb 08)

Owner – Electron Engineering LLC, Brookline, MA

Contract electronic circuit design for a low cost, high volume/high reliability medical device for **Proven Process Medical Devices**. Product focus was analog, microvolt-level sensor signal acquisition and digital processing for a hand-held, disposable, micropower, battery operated surgical device. Electronics worked in conjunction with hydraulic and pneumatic subsystems. Electronics had to be tolerant to EtO gas and electron beam sterilization processes, and low cost given this was a disposable device. Solely responsible for all phases of electronics hardware design, including:

- Design of an electronics hardware module that ensured low component, manufacturing, and testing costs
- Component-level circuit design and simulation of analog sensor and microcontroller-based digital circuitry
- Management of custom LCD design and fabrication outsourcing
- Management of PCB layout and fabrication
- Management of project mechanical (as needed for electronics) and software engineers
- All phases of prototyping, including initial hand-built prototypes and PCB prototypes
- Component-level circuit design of manufacturing test equipment
- Design of manufacturing functional test protocols
- Design, implementation, and documentation of FDA verification test protocols
- Sourcing components, including aggressive vendor negotiating to obtain high volume competitive pricing
- Identifying vendors and setting up multi-million dollar business relationships to support high volume manufacturing (500K / year after ramp up)

(June 02 – July 03)

Electrical Engineer, Engineering and Technology – Design Continuum, Inc., West Newton, MA

Involved in all aspects of electrical engineering to bring products from concept through mass production for a product design firm. Sought new business relationships and brought revenue generating projects to the company. Projects ranged from consumer products, scientific and medical devices, and interactive art to industrial equipment and controls. Design responsibilities included:

- Component-level circuit design and SPICE simulation of analog, digital, mixed signal, and microcontroller circuitry
- Electromechanical design
- Collaboration with design strategy group, industrial designers and mechanical engineers to explore how to meet end user's product design needs, and how to package electronics into overall product design
- Architecting and writing firmware for embedded microcontroller based devices
- Constructing physical prototypes
- Component selection to meet client's manufacturing target costs, product performance, and agency approval needs
- Management of PCB layout, design, and fabrication using in-house and external resources
- Developing strategic client-vendor relationships
- Creating system-level designs and performing RF / Wireless sub-circuit design verification and testing
- Participation in client sales meetings and proposal reviews

(Dec 99 – June 02)

Product Design Engineer – Scott Aviation (Health and Safety Division), Monroe, NC

Involved in new product design from concept through production for fixed and portable gas detection instrumentation, and for portable electronic safety devices for firefighters. This included a hand-held infrared vision unit that aids firefighters in finding people and safe exit points in smoke-induced blackout conditions. Responsible for:

- Component-level design of analog, digital, mixed signal, and embedded microcontroller circuits, SPICE sim
- PCB layout and design
- Extensive hand-built physical prototype construction, testing and debugging
- Design and development of assembly language based, high reliability firmware for microcontroller hardware
- Creation of manufacturing production line test procedures (ISO 9000)
- Component and system-level design of manufacturing test equipment
- Design of functionality / cost improvements to existing product line

All designs were compliant with ANSI / UL 913 intrinsic safety specifications for Class 1, 2, 3, Division 1 explosive gas atmospheres. *(Sept 98 – Nov 99)*

Electronic Design Engineer / Exhibits Specialist – Discovery Place Inc., Charlotte, NC

Responsible for designing, SPICE simulating, prototyping, constructing, documenting and installing custom application-specific analog, digital, mixed signal and microprocessor based electronic circuitry used in various new sensor-based, interactive exhibits for a hands-on science museum. Responsible for embedded software design and development to support microprocessor-based designs. Troubleshoot, repaired, maintained and designed upgrades to the electronic and electromechanical components of existing exhibits. Maintained and repaired audio, video, computer and theatrical lighting equipment used for in-house and traveling exhibits and science shows. Involved in the creative design process for new in-house and traveling exhibits. Presented small science workshops for children. *(May 95 – Feb 98)*

Freelance Electronic / Electromechanical Designer & Consultant, Charlotte, NC and Indianapolis, IN

Responsible for design, prototyping, construction, software development and complete project documentation services from concept through assembled and tested units. Some interesting projects included:

- **Microprocessor Controlled Solid-State Audio Record / Playback Unit** – Created operator interface for industrial textile machines that communicated (RS-485) with machine's PLC. Unit provided verbal warnings of hazardous conditions, reports of machine status and prompts for operator input.
- **Lighting Controller for World's Largest Anatomically Correct Human Eyeball Model** – Designed and built microcontroller based circuit and wrote firmware to sequence graphic panel backlighting for a museum exhibit. Lighting was in sync with audio script identifying anatomical features for museum visitors walking through the eyeball. I was contracted by the original artist who built this exhibit for the Discovery Place science museum.
- **Electric Eel Discharge Display Meter** – Designed and built complete instrumentation system and large LED-bar graph display for aquatic museum exhibit that showed the electric eel's relative discharge voltage magnitude and polarity. Submerged probe system fed overload-protected instrumentation amplifier front end, followed by logarithmically responding display drivers for bipolar, 60dB display (eels have quite the dynamic range...).
- **Microprocessor-Based Motion Control System** – Designed and constructed control system hardware and created firmware to provide adjustable timing and sequence control for 26 synchronous AC motors. Unit was used to control motion in a dynamic, large scale mixed media art exhibit.
- **Nitrous Oxide Injection Controller** – Designed and built an all analog controller that used a K-Type thermocouple as exhaust gas temperature input to servo NO₂ injector solenoid valve. This prevented thermal / mechanical damage to a street race car's engine. Important features included user adjustable temperature, gain, and hysteresis settings and built in self-test modes.
- **Electronic Engine Fuel / Air Mixture Control** – Designed and constructed an oxygen sensor-based, analog, closed-loop servo controller for butterfly air valve assembly with user adjustable set point and gain. Valve was used to provide fuel / air mixture ratio control for experimental automotive vapor fuel system. *(1994 – 1999)*

Avionics Repair Technician – In-Air Aviation, Indianapolis, IN

Performed testing, troubleshooting and component-level repair for return-to-service of analog Air Data Computers used in the B-727, B-737, DC-8, and DC-9 aircraft auto-flight system. FAA repair station. *(June 94 – Aug 94)*

Mechanical / Electromechanical Experience

Flight Line Aircraft Mechanic – Piedmont Aviation Services Inc., Monroe, NC

Performed scheduled and unscheduled inspection, maintenance, troubleshooting and repair on the following commercial aircraft types: B-737-200 and CL-600. Had Engine Run / Aircraft Taxi qualifications. Worked on engine, airframe, electrical, and avionics systems in a flight line setting at Charlotte-Douglas International Airport, NC.

(Part-time / On-call, Jan 97 – Sept 99)

Industrial Textile Machine Mechanic / Fabricator – Lygad Inc., Matthews, NC

Assisted in fabrication (gas welding, general machining), installation, and troubleshooting of design modifications made to existing machinery. Worked with motor drives, PLCs, pneumatics, and associated motion control components. Performed redesign and documentation of machine electrical and motor control systems to upgrade machine functionality. Prototyped, tested, debugged and implemented the redesigns.

(Oct 94 – May 95)

Flight Line Aircraft Mechanic / Lead Night Shift Mechanic – Mountain Air Cargo, Denver, NC

Performed troubleshooting and maintenance of avionics, engine, and airframe systems to ensure on-time departure of home-based and quick-turn cargo aircraft in a fast paced flight line environment. Aircraft types included: F-27, SD3-30 and C208. Had Engine Run / Aircraft Taxi qualifications and Required Inspection Item sign-off authority. Set-up and established Oklahoma City maintenance base, and ran single-man outstations on rotating basis in Saint Louis and Oklahoma City. Responsible for Service / Intermediate checks, parts ordering / tracking and general station logistics and operation for CFR Part 121/135 FedEx contractor at the Indianapolis, IN station.

(Mar 93 – June 94)

Airframe and Powerplant Mechanic – Panorama Flight Service, White Plains, NY

Performed troubleshooting and repair of airframe, engines, and electrical systems. Prepared aircraft for 100 hour and annual inspections. Performed general preventative and required maintenance for corporate light twins and general aviation aircraft.

(Summer Internship, May 90 – Aug 90)

Lab Instructor – Embry-Riddle Aeronautical University, Daytona Beach, FL

Taught troubleshooting techniques and designed repair exercises for reciprocating engines. Maintained and repaired training engines and ground support equipment. Completed overhaul of a P&W R-985 engine.

(Feb 89 – Dec 89)

Patents

- Debris Sensor For Cleaning Apparatus 7,459,871 / 7,288,912 / 6,956,348 / 8,253,368 / 8,378,613
- Autonomous Robot Auto-Docking And Energy Management Systems And Methods 7,332,890 / 20050156562 / 20070114975 / 20070267998 / 20080007203 / 8,390,251
- Robot Confinement 20080039974
- Lawn Care Robot 20080109126 / 8,634,960
- Remote Fire Extinguisher Station Inspection 7,574,911 / 7,188,679 / 6,585,055 / 6,488,099
- Navigation Control System For A Robotic Device 8,386,081 / 8,428,778
- Method Of Charging A Battery Of A Robotic Device EP 1921523 B1

Education

B.S. Aircraft Mechanics and Avionics Engineering, Embry-Riddle Aeronautical University

Dean's List, 3.56/4.0 cumulative GPA

Professional Licenses

FCC: General Radiotelephone Operator's License with Ship Radar Endorsement

FAA: Airframe & Powerplant Mechanic licenses
Private Pilot

Other Skills

- Milling machine / Lathe / General machine shop metal work and fabrication
- TIG / Oxy-Acetylene welding and cutting, and plasma cutting
- Fine pitch surface mount hand soldering / rework (like a brain surgeon)
- Hands-on electrical / mechanical engineering prototype design, fabrication / building, testing, debug

A graphical work history timeline is **On The Next Page**.

References available upon request.

Career Mission Statement

The work I do must be meaningful in the world. This is more important to me than any of the other aspects that all come together to make up my job or career, money included.

I choose to directly play a role in one or more realms of making people safer, healthier, or simply even a little happier because their most basic human needs for food, clean water, health care, shelter, knowledge, hope, and freedom from harm are being met.

The following are all fantastic examples of the types of work I believe in, I am passionate about, and I will put my heart into:

Medical devices / diagnostic equipment, defense / anti-terrorism / first responder equipment and systems, green energy systems / third world sustainable energy systems, aerospace development and advancement, bicycle safety enhancement devices, sustainable transportation, agricultural production enhancement, third world water purification development, environmental pollution mitigation, safety equipment for manufacturing environments, exercise / physical rehabilitation equipment, public art installations, education and pushing boundaries of knowledge – this also includes theoretical or applied scientific / engineering research whose ultimate outcome falls into any of the above, or just advances humanity for the better.

If you have a project, job, or consulting need that falls somewhere in the neighborhood of these examples then please don't hesitate to contact me. Perhaps I can help make a difference to your organization and beyond.

-David Cohen

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