Resume   David A. Cohen

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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; High frequency PCB design and layout; SPICE simulation
- Electronic and electromechanical sensor design; System and motion control design; Robotics
- Hand-prototyping of circuits and systems, proof of concept model construction, test fixture design / building
- High volume manufacturing, production, and sustaining engineering; Overseas manufacturing and sourcing
- Embedded firmware architecture high-level and system design to ensure efficient hardware – software system
- Design process and documentation; UL, CE, FCC, and FDA approval requirements and certification processes
- Risk management, failure modes and effects analysis (FMEA); Design for compliance
- Safety agency testing management; EMC / EMI mitigation design and testing; Signal integrity design / testing
- 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 / Principal Electronic Design Engineer – Electron Engineering LLC, Brookline, MA

Electron Engineering, LLC provides system-level, and component-level electronic and electromechanical design, primarily for medical devices and robotic surgical systems. Expertise in design for compliance with UL, CE, FDA and FCC agencies, risk analysis and mitigation. Services include analog, digital, mixed-signal, embedded, sensor and RF circuit design, PCB layout, engineering business and process development and partnership building, hand-prototyping and fabrication, including light machining and TIG welding.

In-house test and measurement equipment including high-speed oscilloscopes, logic analyzers, vector network and spectrum / signal analyzers, and RF signal generators, function generators, DC- low frequency network analyzer, near-field probes and amplifiers, signal conditioning modules, high-speed current probes and differential amplifiers, general DMMs, power supplies, etc. Surface mount soldering and desoldering equipment including microscope setup. Thousands of electronic components stocked for rapid prototyping capability   *(2003 – Present)*

Some interesting clients / projects include:

Verb Surgical (Feb 17 – Current): Robotic surgical system. Designed a near-field RF communication system to wirelessly transfer power and data between parts of the robotic surgical system. Component-level circuit design and RF simulation, hand-prototyping, PCB design and layout, including antenna design. Design was built on previous third-party prototype work that had been done. Re-design of a robotic motion axis, joint motor driver and sensor acquisition module. All designs have been functional on the first spin.

Boston Dynamics (Oct 18 – Jan 19): Robotic platform control and motor drive circuitry EMC mitigation. EMC / EMI chamber testing to identify issues, designed in modifications to existing circuitry and PCB layout, and cable system, to help pass FCC regulatory compliance testing.

Harvard University Wyss Institute (July 14 – Dec 14): Designed wearable, custom data-acquisition system for human body exoskeleton suit robotics project. Complete component-level circuit design, hand prototyping, and PCB design and layout, from napkin sketch to fully functioning circuit boards in one spin on a tight schedule.

Slightly bigger than a credit card PCB containing a microcontroller, LiPo battery and on-board charging circuit, CAN bus interface, 9-Axis IMU, custom designed log-amp based galvanic skin response measurement circuit, ambient temperature sensor, barometric pressure sensor, humidity sensor, heartrate sensor, IR non-contact skin temperature sensor, GPS receiver, Bluetooth transceiver, LED, sound and vibration haptics, SD card memory interface, and complete power-management system. Board communicated data to central embedded computer system via CAN bus.

Medrobotics (June 09 – Oct 13): Robotic surgical system. Responsible for electronic and electromechanical system architecture design, embedded computer architecture system design, risk analysis, component-level analog, digital, and mixed-signal circuit and sensor design, hand-prototyping, experimentation, debugging and systems integration for a robotic snake based, minimally invasive, flexible, laparoscopic surgical system. Other responsibilities included EMC / EMI mitigation design, and mitigation activities, FDA compliant design documentation activities, and testing.

Cue Acoustics (Mar 07 – Aug 08): Consumer device; table top radio that competed in the same space as the Bose Wave Radio. Project management, development of internal company practices and procedures for documentation control, revision control and knowledge capture, general vendor partnership building, business development, third party design resource management, system level design for ESD and EMI issue mitigation. Worked to place the design into high volume local and overseas manufacturing while working to reduce the BOM costs.

Lead Electronic Design Engineer, Consumer Robotics Division – <u>iRobot Corp.</u>, 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. 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)*

Contract Electrical Engineer – <u>Proven Process Medical Devices</u>, East Walpole, MA
Start to finish component level circuit design for a low cost, high volume/high reliability medical device for Boston Scientific. Product focus was microvolt-level, strain-gauge sensor signal acquisition, and microcontroller 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. 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 – <u>Design Continuum, Inc.</u>, 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 hand-made prototypes, and proof of concept models and devices
- Component selection to meet client's manufacturing 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 – <u>Scott Aviation</u> (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 – <u>Discovery Place Inc.</u>, 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. Troubleshot, 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, installation 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 NO_2 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)*

Mechanical / Electromechanical Experience (major positions)

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 (Indy, IN Station)
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)*

Patents

Autonomous robot auto-docking and energy management systems and methods: 9,931,750 / 9,884,423 / 9,550,294 / 9,215,957 / 8,854,001 / 8,749,196 / 8,461,803 / 8,390,251 / 7,332,890

Articulating robotic probes, system and methods incorporating the same, and methods for performing surgical procedures: 15/315,868

Navigational control system for a robotic device: 9,949,608 / 8,781,626 / 8,428,778 / 8,386,081

Method of docking an autonomous robot: EP2273336 (A2) / EP2273335 (A2)

Robot confinement: 9,713,302 / 8,868,237 / 8,781,627

Method of charging a battery of a robotic device: EP1921523 (A2)

Lawn care robot: 10,037,038 / 9,043,953 / 9,043,952 / 8,954,193 / 8,634,960

Remote fire extinguisher station inspection: 7,574,911 / 7,188,679 / 6,585,055 / 6,488,099

Debris sensor for cleaning apparatus: 10,182,693, / 9,883,783 / 9,591,959 / 9,144,361 / 8,598,829 / 8,378,613 / 8,253,368 / 7,459,871 / 7,288,912 / 6,956,348 / 8,456,125

Programming and diagnostic tool for a mobile robot: WO2006002385 (A1)

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

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, 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, defense / anti-terrorism / first responder equipment and systems, 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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