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Summary of Technical Background, Experiences, and Skills

Electro-Magnetics

- Designed, tested, and produced several specialized electro-magnetic linear actuators (voice coil actuators) including static and dynamic magnetic simulation, materials and performance optimization, and cost reduction.
- Versed in electro-magnetic theory of permanent rare-earth (NdFeB and SmCo) magnets, ferro-magnetic materials with inherent B-H non-linearity, optimizing and modeling back EMF & eddy-currents, modeling & optimizing thermal performance, and integrating unconventional magnetic materials.
- Versed in magnetic bearings construction and the associated electric control systems (servo control of shaft position)
- Design, simulation, and implementation of passive permanent magnet non-linear springs
- Familiarity with and hand-on use of magnetic Finite Element software tools such as Ansoft 2D/3D, Terra Analysis, Ansys, Cosmos

Rotary Machines

- Experience with all types of rotary electrical motors and generators (synchronous AC and asynchronous 'squirrel cage' motors up to 700 kW, 1- phase and 3-phase machines and systems, DC motors up to 500 kW, 3-phase AC turbine-generator sets up to 4 MW, variable frequency drives for asynchronous motors up to 350 kW, stepper motors and drives, BLDC motors and drives, reluctance motors)
- Designed and conducted Computational Fluid Dynamics (CFD) simulation/analysis on a Tesla Turbine design (self-inspired)
- Self-inspired interest and study into combustion turbines (gas turbines, jet engines, propane combustors) as well as associated nozzle design and CFD
- Design, CFD, and construction/assembly of a small impulse turbine for personal education
- Implementation of numerous small motor drives for testing (both open-loop DC and steppers as well as closed-loop)
- Familiarity with air motors, hydraulic motors, swash-plate type pumps, hydraulic pumps, air compression technologies, internal combustion engines, compressed air turbines (up to 100,000 rpm)
- Self-inspired interest in rotary mechanical energy storage (flywheel) design and trade-offs

Fluid Systems

- Skilled with Computational Fluid Dynamics (CFD) simulation tools such as CFDesign
- Expert in fluid power technologies, design, use, integration, components, markets, etc to include system design, component design, component and system sales / marketing, competitive

analysis of emerging technologies, holder of multiple patents & pending patents related to fluid power components

- Experience with 1000psig & 3000psig oil-hydraulic systems, up to 4500psig compressed air systems, 1000psig water-hydraulic systems, up to 700psig steam systems, low and high pressure air-over-water hydraulic systems, vacuum systems, and all associated fluid energy components including valves, pipes, fitting, tubing gauges, pumps, motors, accumulators, etc

- Experience with several types of thermo-dynamic cycles such as Rankine cycles and refrigeration cycles; skilled in thermodynamic systems analysis and use of fluid property databases (steam tables, Mollier diagrams for various fluids, etc)

- Some experience with cryogenic fluids and applications

- Experience with several types of heat exchangers, construction and use

Electronics & Embedded Software Experience

- Hands-on use of standard electronics design (EDA), PCB Layout, and simulation tools (Altium, EagleCAD, PADS, DipTrace, various free / low-cost tools)

- Embedded wireless designs (ISM band, ZigBee, FM) for remote device actuation, sensing, monitoring, and control

- Embedded C and assembly programming for Atmel and PIC families of micro-controller products

- Embedded products with HMI via LCD's and touch screens

- Analog signal conditioning and filtering; standard analog signal industrial formats (4-20mA, 0-5V, 0-10V); power PWM motor drives using complex integrated circuit devices such as A3959, L298, etc.

- Digital serial protocols including application and physical layers (RS232/485, I2C, SPI, USB)

- Proficient with the use of standard electronic test instruments such as function generator, oscilloscope, DMM, soldering station, SMT soldering binocular scope, and supporting tools and equipment

- Familiar with LabView and associated hardware targets; familiar with Simulink xPC target and applications; familiar with several low-cost after-market data acquisition and control products (e.g. Measurement Computing, LabJack)

- Home electronics lab bench (oscilloscope, function generator, soldering station, microscope, and required hand tools)

Mechanical Experience

- Hands-on experience with solid modeling tools (Autodesk Inventor, Solidworks)

- Preparation of mechanical design for production by preparing drawings (including dimensioning and tolerancing), procedures, specifying materials, and Bill of Materials

- Hands-on use of countless hand-tools, power-tools, and powered machinery including lathe, Bridgeport milling machine, CNC milling machine, drill press, horizontal and vertical band saws,

press; machining of common materials including Aluminum, Brass, Alloy Steel, Stainless Steel, Graphite, Delrin, UHMW, Polycarbonate, Bronze

- Familiar with mechanical concepts (gears, pulleys, lead screw drives, vibration, stress/strain of materials, torque, power, viscosity/lubricity)
- Concurrent integrated electro-mechanical design of various products involving moving parts, sensor, electronic circuits, controls, and mechanical interfacing
- Home machine shop (bench-top lathe, drill press, horizontal band saw)

Control Systems Design and Implementation

- Skilled in physics modeling of complex dynamic systems using numerical analysis software tools such as Matlab & Simulink
- Embedded, battery powered, adaptive hydraulic damping systems and components using classical tools such as MatLab and Simulink (see Design News article regarding Cannondale Bicycle)
- Embedded low pressure medical gas flow control device functioning as a servo valve with embedded PIC micro-controller and integrated linear actuator and position sensor
- Automatic dynamic control of various physical processes (linear position, rotary position, tank pressure, gas mass flow controllers, force application) to include systems analysis and modeling (Simulink), control system theoretical design (Matlab, Simulink), implementation, and testing to include hardware-in-the-loop.
- Familiarity and/or use of various common control algorithms (PID, Kalman Filters, PVA, Adaptive Control, Gain Scheduling, Model-Reference Control, Sliding Mode, classical FIR and IIR filters, Analog filtering techniques, Lead/Lag compensators, etc)
- Multiple-input control systems and cascaded controls development

Manufacturing and Prototyping Technologies

- Machining (lathe, mill, bandsaw, drill press, CNC routers, CNC lates, CNC milling, 4-5 axis machining centers, grinders, honing machines, swiss screw machines, etc)
- PCB manufacturing, pick-and-place circuit population machines, re-flow ovens and wave soldering, hand soldering, flexible printed circuits, potting technologies
- Injection molding
- Casting (lost core, investment, polymer resin)
- Rapid Prototyping technologies (SLA, FDM, etc)

Materials Science

- Familiarity and experience with numerous materials
  - Metals – most ferrous alloy steels (1018, 1045, 12L14, 1215), cast iron, aluminum alloys (2024, , 5052, 6061, 7075), copper alloys (brass 360, phosphor bronze 9XX), stainless

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steel (302, 303, 316, 416, 440C, Nitronic 60, 18-8, 17-4ph), exotics (Inconel 625, 650, 750, titanium)
- Plastics – Nylon, Polyethylene, Acetal, Teflon, PEEK, Polycarbonate, ABS, PVC, PET
- Other Non-Metals – glass, graphite, fiberglass, carbon fiber, epoxies, resins
- Versed in manufacturing, thermal performance, costs, and handling of various materials such as those above.

Government / Naval Experience

- Served aboard a sea-going nuclear powered submarine (USS Seawolf) as a nuclear propulsion plant operator and plant supervisor.
- Acted as a Nuclear Submarine Maintenance / Repair Depot liaison to interface between the Navy ships, shore-based naval repair organizations, and civilian repair technical expertise; worked closely with engineering and management at General Dynamics / EB to ensure timely, cost effective completion of complex maintenance activities aboard Naval assets.
- Director of a Nuclear waste water processing facility responsible for training, qualifications, and safe operation of the facility to process >5,000 gallons per month of radioactive waste water into pure water and thousands of pounds of radioactive waste by-products.
- Held a SECRET security clearance until separation in 2003; easily reinstated.

Education (of others)

- Served as an adjunct professor for the University of New Haven EE Department
- Spear-headed a 'first of its kind' course at the University involving robotics systems design, implementation, and construction
- Frequently sought out as a technical resource on a variety of subjects from a wide range of personnel (educators, students, academics, entrepreneurs, peers, and co-workers)