

- Characterize 2 Brushed and 1 Brushed DC Motors for operation. Generate Torque and Speed Curves to prove meet vendor datasheets. Identified range of duty cycle with respect to Pulse-Width Modulated Switching Frequency to assure Maximum Torque and Motor Current isn't exceeded. Extend to Monte Carlo Analysis with known tolerances. Select Motor Driver ICs and associated circuitry for schematic. Begin modeling of motor, encoder, load and parasitic torques for control loop. Work with Software Control to complete the control loop. Project Status: Initial Development.
- Re-Purpose Client Pyrotechnic Driver Design originally for Munition Fin Deployment to do same for Thermal Batteries. Slight design change to limit current and accept much lower voltage input. Performed LTSpice Analysis to validate operation. Project Status: Circuit Board Layout.
- Re-Use Power Architecture for one Control Actuator System to another. No changes. Switching Regulators and Low-Dropout Regulators (LDO) for FPGA and Microcontroller Loads as well as Motor Drivers. 1.2VDC to 10.5VDC output. Most less than 1A. Perform LTSpice Monte Carlo Analysis to mimic Worse Case Analysis. Project Status: Begin Design Verification Testing.
- Housekeeping Power Supply Design for the Control Actuator System Portion of a passively dropped weapon that becomes in-mission Laser Controlled. Linear Low-Dropout Regulators, Switching Regulators will be used to create 1.2V to 8V, Voltage outputs from a 28VDC battery source. Most all <1 Ampere loads. Requires a unique hold-up 28VDC Input need that is to be actively switched. Design effort includes analysis and worse case simulation, circuit board development and bill-of-material creation. Project Status: Design Verification Testing of prototype
- Perform analysis, Monte Carlo Simulations and suggest design change solutions for a High-Velocity Defense Interceptor. Housekeeping power for Field Programmable Gate Array (FPGA) loads: Switching Regulators, LDOs and Load Switches. 28VIN, nom. Sub-3.3Vout. 10mA to 36A loads. Perform Design Verification Testing on all Housekeeping Voltage Rails. Project Status: Customer lost contract bid.
- Perform custom design, analysis and simulation for a Differential Mode (DM) and Common Mode (CM) Electromagnetic Interference (EMI) Filter to replace a large Custom Off The Shelf (COTS) solution to meet size reduction requirements. Test a COTS Power Converter Design for EMI profile for which to design EMI Filter. Characterize COTS CM Chokes for LTSpice Simulation and Analysis. Infuse Chassis coupling Capacitors to add with CM Design. Application: decades-old mature munition Flight Termination System (FTS). Project Status: Begin Design Verification Testing.
- Perform LTSpice analysis on Overvoltage Shutdown analog circuits, enable circuits for COTS Power Converters, LDOs, Voltage References and Negative Voltage Charge Pumps. Identify design changes necessary to ensure robust design. Application: decades-old mature munition FTS. Project Status: Design Verification Testing.
- Perform Nominal LTSpice Analysis to validate the design of 8 LDOs and 3 Load switches for a Design Life Extension on a decades-old mature munition. Sub-12VIN. Sub-3.3Vout. Sub 810mA output load. Provided boilerplate for Worse Case

Analysis via Monte Carlo Analysis to client Responsible Design Engineers to complete analysis rigor. Function as Subject Matter Expert to critique analysis results. Project Status: Hardware Design Verification Testing complete.

- **Design Negative Flyback Regulator for an Audio Amplifier BIAS Supply. 10VDC Input, -25VDC +/-3V 50mA output. Uses innovative Primary-Side Feedback with no auxiliary feedback winding. Perform LTSpice Analysis to verify design. Project Status: Hardware Design Verification Testing complete.**
- **Design Housekeeping Power Supplies for Mission Computer and Target and Guidance Circuit Cards with FPGA loads. Switching Regulators and LDO Linear Regulators. 10VDC input, 1.320VDC +/-3.5% 2.4A Switcher output, 1.050VDC +/-60mV, 2.4A LDO output. 3.3VDC +/- 5% Input, 2.50VDC +/- 5% 86mA LDO Output. LTSpice Analysis to verify design, pre-layout. 3.3VDC +/- 5% Input, 675mV +/-3% Output DDR Memory Linear Regulator with 683mA Load. Project Status: Design Verification Testing.**
- **Design Housekeeping Power Supplies for Ultra Miniature Control Actuator System (CAS) to control fins on a munition. +/- 20V Battery Input, +12V and +5V for Motor Drive. +3.3V and +1.2V for Controller. Hundreds of milliamps load on all power Supplies. Use Switching Power supply modules with internal MOSFETs and inductors for Motor Drive, LDOs used for powering the Controller. Design MIL-STD-704F DM Filters as needed for architecture. Simulate using LTSpice. Project Status: Design Verification Testing.**
- **Re-design through LTSpice simulation, Housekeeping Power Supplies for a Test Equipment Organization providing Radio Frequency(RF), Laser and other Low Noise Sources to Government Prime Contractors. 21 Power Rails. 15 Linear Regulator, LDOs. 6 Switching Regulators using Off-The Shelf Power Converter Modules. 24V to 3.3V. 50mA to 3A. Project Status: Client lost contract.**
- **Design of an active Diode-OR circuit to provide MIL-STD-704A 28VDC Power or Battery for various loads for a munitions application. Features included 32A current sensor, voltage and current telemetry, ESD protection and capacitive hold-up. Design also included housekeeping 5VDC and 12VDC LDOs. Project status: Next-Level Integration Testing.**
- **Independent LTSpice Simulation analysis of a Government Prime Contractors Munition Product Multi-Function Power Unit designed by a Small Business. Analyze Control Loops for a 115VDC, 400Hz Inverter as well as a 28VDC Battery Fed 200V and 300V 5kW Boost Converter. Also, similar support for Boost Converter input to a 28VOUT/7A Buck Converter. Project status: Support complete.**
- **Analog Circuit Design and Power Converter Design Consulting for a Commercial Access to Space, Private Corporation. Mentored younger design engineers with their responsible circuit card assembly (CCA) designs: Voltage Distribution, Load Switch and Analog Control. Performed extensive LTSpice Monte Carlo Analyses as infusion for design changes to said CCAs, including housekeeping LDOs. Project status: Support complete.**
- **Power Converter Design Consulting for a Commercial Access to Space, Private Corporation. Design reviewed, critiqued and recommended design changes to an**

outsourced Large Business Battery Control Black Box analog and power conversion circuitry. Assisted said outsourced firms design engineers with LTspice analysis of a Multi-DC Voltage Input Flyback Power Converter, 12V/1A with opto-isolated feedback. Project status: Support complete.

- **Power Converter Design Support for a Commercial Access to Space, Private Corporation.** 120VDC Fuel Cell Input to 120VDC/2.5kW Solar Array(SA) Load Output, non-isolated Single-Ended Primary Inductance Converter (SEPIC) Converter. With an additional Battery support for the SA Load, only a current command from the SA to the Fuel Cell was needed as a control scheme to have the SEPIC deliver load current to the SA. Project status: Launched 2024.
- **System on a Chip(SoC) FPGA.** 17 Power Rails. 11 LDOs: 9 for RF Loads. 6 Switching Regulators using Off-The Shelf Power Converter Modules. 0.8V to 5V. 200mA to 36A. Project Status: re-use standard for corporate use. Design used as basis for a Wideband Data-Link application.
- **MIL-STD-704F to 16.7VDC, 2 Watt output Isolated Flyback Converter design for Built-In Test for a Motor Controller.** Concept was to stimulate the motor without having to move. Used Off-The Shelf Power Converter Modules to address challenging space restriction. Project status: Production Momentum.
- **20A, 500ms SQUIB Driver Design for FTS for a Hypersonic Missile application.** Project status: Support complete.
- **Designed 71 Power Converters to go on 7 circuit boards for FPGA and RF Point of Load (POL) applications.** 10Vin to 0.85V to 3.3V Output with 3% Total Output Tolerance Requirements, 6 mWout to 28Wout. 400 kHz to 1.5Mhz Frequency Switching Converters and LDOs. Application was an Internal Research and Development (IRAD) Small Advanced Capabilities Missile (SACM). Project status: Support complete.
- **Designed a Flyback Magnetic for a 28V, 250W Output Housekeeping Power Supply with a 440VRMS, 60 Hz rectified 3-phase input.** Project status: product infusion. Project Status: Effort complete.
- **Power Transformer and Boost Inductor Magnetics designed for a Power Factor Corrector (PFC).** 440VRMS, 60 Hz, 3-phase input with a 600VDC, 5 kW output. Project Status: Effort complete.
- **EMI Filter Design for a 440VRMS, 3-phase, 60 Hz, 5kW load power system for an Office of Naval Research Electronic Warfare Application.** Project Status: Effort complete.
- **Designed a 150ms hold-up circuit with current limiter for the inputs to 28VDC and 48VDC Point of Load (POL) 250W and 5kW Converters, respectively.** Project Status: Effort complete.

- **Self-Oscillating Insulated Gate Bipolar Transistor (IGBT) Gate Drive for Soft-Start Circuit for a 115VAC, 3-Phase, 400 Hz Input to a 270VDCout, 100 kW Bi-Directional Inverter-Converter for an Avionics Application on a Black Program. Project Status: Support complete.**
- **Current Transformer design for a 115VAC, 3-Phase, 400 Hz Input to a 270VDCout, 100 kW Bi-Directional Inverter-Converter for an Avionics Application on a Black Program. Project Status: Support complete.**
- **MIL-STD-461F EMI Filter Design for a 115VAC, 3-Phase, 400 Hz Input to a 270VDCout, 100 kW Bi-Directional Inverter-Converter for a Avionics Application on a Black Program. Also designed Lightning Protection Circuitry on vehicle inputs per DO-160G, Section 22, and Electro-Static Discharge Circuitry per MIL-STD-461F. Project Status: Program cancelled.**
- **Integrate a Canted Coiled Spring into a Printed Circuit Board to contact with 1 inch bus bar for current sense, sampling, EMI Filtering. Patent planned. Project Status: Flight Test.**
- **Successful Design Verification and Infant Mortality Testing at -74C for a Linear Regulator, rated at -40C for a Seeker in a Laser-Guided Munition. Project Status: Product Fielded.**
- **PACER Proprietary Designed Product of a Line Voltage Step Transient Device for use in qualifying electronic boxes to power standards like MIL-STD-704. Step from min to max line voltage with a Unit Under Test with loads up to 150W. 28VDC, 120VDC and 270VDC Systems. Project Status: Product Fielded.**
- **PACER Proprietary Designed Product of a 60 cu. in. DC Input Power Switch for Electronic Laboratory Applications. Simulates Relay Chatter, Intermittent Power, Black and Brown-Outs, Transients and Surges. Customized Duty Cycle and Frequency. 28VDC, 120VDC and 270VDC Standards with up to 50A peak. Project Status: Product Fielded.**
- **Corrected control loop issue with a Digital Power Supply for a Missile Customer. Performed verification testing on same supply. Project Status: Product Fielded.**
- **MIL-STD-1399 compatible Housekeeping Power Architecture Design for a Secret Launcher. 120VAC, 60 Hz, Single Phase Input. Demonstration phase begins with Military Off-The-Shelf(MOTS) Power Converters with minimal custom circuitry. Project Status: Product Fielded.**
- **Participated in a Failure Investigation for an Air-to-Air Missile Platform. Performed Power Quality Lab Testing on two products to validate or disprove root cause. Project Status: Effort complete.**
- **Design out obsolescence of a housekeeping power sub-assembly on a mature Air-to-Air Missile design. Performed a Electronic Sub-Assembly Bill of Material (BOM) scrub. Identified equal or better than board-level electronic components to replace obsolete components. The goal was to find devices that directly install into the Printed-Circuit Board (PCB) without having to re-layout the PCB. Project Status: Product Fielded.**

- Analyzed the feasibility of an off-the-shelf Power Factor Correcting 230VAC, Single Phase Input, 4.5kV/1.8kW output power supply to drive a magnetron to make plasma for an International Space Station Experiment. Make recommendations for design changes to meet NASA Requirements. Project Status: Effort complete.
- Responsible for the design of a Multi-Converter Hybrid for the NASA Orion Crew Exploration Vehicle. 120VDC Input. 41V/32W Isolated SEPIC Converter to power Pyrotechnics. Multi-Output Flyback/10W to power Housekeeping. Perform Worst Case Analysis using MATHCAD and LTSPICE. Correct the design accordingly: add snubbing, add external precision error amp to tighten static regulation, correct loop stability to eliminate beat in output. Project Status: 2023 Launch and Splashdown successful.
- Re-design for re-use a 500 kHz, Voltage-Mode Active-Clamp Forward Converter for a 555 Watt Pulse Power Application for an Active Seeker Application. Performed SIMPLIS, MATHCAD modeling and Electrical Stress Analysis. Tested and delivered 7 prototypes. Project Status: Product Fielded.
- Re-designed, troubleshot, stabilized the control loop, tested and delivered, to the next level of integration, 12 Circuit Card Assemblies that provide multiple converter housekeeping power to the data-link section for 2 different Missile platforms. Corrected the design to double the power of one of these converters for a Pulsed-Power Mode Event. Used PSpice to model sub-circuits. Project Status: Product Fielded.
- Performed Research and Development on Magnetic Winding Schemes for Wireless Inductive Charging Applications. Project Status: Effort complete.
- Provided an Inrush Current Limit Solution for the input of an AC/DC Brick for a Satellite Communication Application to eliminate Power Train Series Resistor and Thyristor field failures. Project Status: Effort complete.
- Corrected Design Errors to a fielded Universal Power Module (UPM): 24VDCin multi-output Buck Regulator (12V/2A, 10V/5A, -5V/0.25A) for a Satellite Communication Application. Changed Pass MOSFET to address Transient Start-Up Issues. Corrected a mis-applied Transient Voltage Suppressor to eliminate failures of expensive down-stream DC/DC Converter Bricks. Added burdening loads to outputs to correct objectionable transient load overshoot issues. Project Status: Effort complete.
- Designed an Innovative Emitter-Coupled Energy Harvester to provide a -5VDC output at 10mA for a Battery Management System for a Business Aircraft. Project Status: Product Fielded.
- Developed a 270VDC to 28VDC/25Aout Phase-Shifted Modulated Converter for an Uninterruptable Power Supply for a Business Aircraft Lithium-Ion Battery Application. Maximum efficiency was 96.3% at low line and full load. Project Status: Product Fielded.
- Twice reviewed a Client's Design of a TOPSwitch-based, 380VDCin/54VDCout, 35 Watt, Fly-back Converter. Made numerous suggestions for change. Most notable: Discontinuous Current Operation, Output Capacitor, tighter Opto-Coupler Current-Transfer Ratio (CTR), add EMI Filter, Snubber Design, use TO-220 device with Heat Sink to dissipate 1.8W max in TOPSwitch. Project Status: Product Fielded.

- Re-designed a 28V Input/4300V Output Inverter to drive a 600W Magnetron. Designed a more efficient Power Transformer at 70% size. Recommended changes to existing fixed frequency drive and control feedback. Project Status: Product Fielded.

Designed a 17-83W Single-Ended Forward Converter with 6 Outputs. Continuous Current. Constant Current Mode. MIL-STD 461E and MIL-STD-704C compatible. Inrush current limiting. Application was a BLACK Government Program. Performed MATHCAD and EXCEL Stress Analysis and Worse-Case Analysis. Efforts included Curve Modeling for Diodes and MOSFETs. Analyses included: Transient, Loop Stability, Output Voltage Dynamic Range, Regulation, Efficiency, Power Train (Gate Drive and Safe Operating Area and Transient Voltage and Switching), Start-Up, Under-Voltage and Overvoltage, Power Dissipation, Fourier Analysis of Main Switching FET, EMI and Filter-Converter Impedance Interaction. Modeled Sub-Circuits such as Opto-Isolator and Voltage Reference IC. Project Status: Product Fielded.

- Developed a resistive load switch for the application of Test Equipment for Custom Power Supplies. Published in NASA Tech Briefs (MFS-31811-1).
- Designed 300VDC/28VDC 10kW Power Converter for Tactical Vehicle Application. Selected Power MOSFETs over IGBTs as the commutating switch of choice. Design could accept three of these devices in parallel. Designed EMI Filters for the input and output in accordance with MIL-STD-461E, which included custom magnetics. Worked closely with a Magnetic Design House for the fabrication of these magnetics as well as Inductors, Power, Gate Drive and Current Transformers. Project Status: Product Fielded.
- Perform assessments of MIL-STD-461 EMI/EMC for tactical vehicle platform from the top level of the tactical vehicle down to dozens of sub-assemblies. Project Status: Effort complete.
- Design of complex circuitry for control of Servos, Motor Circuits, Gimbals, Gyros, Resolvers, Periscopes and Gun Sights for a tactical vehicle application. Design required the selection and application of the standard fare on analog electronics including Op Amps, Analog Multiplexers and A/D Converters. Project Status: Product Fielded.
- Tested, Characterized and Evaluated 3 alternative Li-Ion Battery Platforms for a Microwave Weapons Application as an alternative to an expensive, long-lead SAFT solution. Test was controlled by CAN bus communication. Wrote a complete document with recommended choice alternatives based on actual load, charge and discharge rates from C/5 to 10C and environmental conditions impressed on the batteries. Noted battery hot spots and internal resistance. Project Status: Product Fielded.
- Power Management Design for Sensor Data Acquisition and Gunfire Detection-Location-Range-Caliber Identification. Design was based on use of commercial AA-size Alkaline Batteries. Provided battery characterization using commercial Lithium Batteries for customer consideration for longer-life applications. Project Status: Product Fielded.
- Wireless Sensors Design for Fan Blade Health Monitoring for Hypersonic Wind Tunnels. Selected and Designed-in Lithium batteries. Project Status: Product Installed.

- **Full Signal 15MHz Video/ 800 kHz Deflection for Night Vision Thermal Imager.** Design required a discrete amplifier design for video and the fast deflection axis to meet requirements. Slower Retrace Deflection Axis utilized a Power Op Amp. Project Status: Product Fielded.
- **15 Switching Power Supply Designs:** F-15, F/A-18, V-22, C-130J, International Space Station(ISS) (launch 2008), 0.5 Watts to 300 Watts, 30 kHz to 4 MHz, AA Battery to 400VDC input, AA Battery to 30 kV output. Some power supplies required RAD HARD design of various requirements with different de-rating guidelines and standards. Designed associated custom magnetics.
- **Provide oversight over the Electrical Power Distribution System for a NASA Gravity Probe-B Satellite (GPB).** Solar Arrays, 70AH Batteries, Peak Power Trackers, and the Power Control System/Law. Analyzed and critiqued the MATLAB model for the ability of the Solar Arrays for GPB to provide enough power for the whole mission, including eclipse events of Polar Orbit and self-eclipse.
- **Smart Charger Design for EV-1 Electric Vehicle**
- **Solid State Circuit Breaker Design**
- **Ground Fault Circuit Interrupter Design and White Paper, EV-1 Electric Vehicle**
- **Video, Deflection, and Sync Circuit Design for Rear-Screen Projection Television, Computer Monitors, and Cockpit Displays**