Curriculum Vitae

CLIFFORD B. GERHARD, P.E.

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Cliff Gerhard is a licensed Professional Engineer (California License # 14447) and is currently Senior Principal Engineer, UAV, Electrical at Swift Engineering in San Clemente, CA. He also holds the position of President and Chief Consultant at Generation 3 Engineering, LLC.

Cliff is a third generation Electrical Engineer with many years of technical experience. Much of this experience was gained working as a consultant. He worked with his father, Frank Gerhard (RIP), a pioneer in the field of electronics, for much of his early career. The mentoring his father provided has proved to be invaluable throughout Cliff's career.

To be successful as a consultant requires tremendous amount of dedication and drive. Consultants have to successfully deal with new people and organizations on a regular basis. They are often called in when things are not going well, sometimes in hostile or chaotic environments. A consultant will take on jobs in areas that are outside their comfort zone. This results in a very wide base of experience.

The consultant must be able to quickly and accurately judge the feasibility of a proposed project and give the customer an honest assessment. Because nearly all of a consultant's business comes from referrals and repeat customers, a single unhappy customer can be devastating. To be successful in this role for as long as he has is an indication of Cliff's abilities and how he was able to keep his customers coming back.

Cliff has produced designs used in medical instruments, spacecraft, aircraft, automobiles, motorcycles, emergency vehicles, industrial control, computer products, test equipment, telephony, communications, theme park attractions, consumer products, and toys. His broad experience gives him the tools to tackle the most challenging designs. Cliff is analytical and organized with a firm grasp of engineering fundamentals.

The non-technical experience gained by owning and operating a small business has given him the ability to understand the business side of product development and create designs that can be successful in the marketplace.

SPECIALITIES

Systems Engineering
Power Supply and Battery Systems
Analog and Digital Circuit Design
Embedded Firmware Design
Printed Circuit Board Design

EDUCATION

WEST COAST UNIVERSITY, Los Angeles, CA.

Cliff completed his requirements at night, while working full time, and graduated with honors obtaining the following ABET accredited degree:

Bachelor of Science in Engineering
Option in Electrical Engineering
(magna cum laude)

PROFESSIONAL CERTIFICATIONS

Cliff passed the California Engineer in Training (E.I.T.) exam on his first attempt. He petitioned the board to allow him to take the Professional Engineers License Exams (P.E.) early (normally 4 years of experience is required after passing the E.I.T. exam). The petition was accepted and he was allowed to sit for the P.E. exam, again passing on his first attempt. In this exam, 28% of those who took the test received a passing score.

PROFESSIONAL EXPERIENCE

October 2020 to Present
Swift Engineering Inc. – R&D Electrical Engineer San Clemente, CA

After more than 10 years in a key role as Principal Electrical Engineer with RED Digital Cinema, Cliff decided on a change in direction. His latest position at Swift Engineering has the title Senior Principal Engineer, UAV, Electrical working, primarily on the SULE (Swift Ultra Long Endurance) UAV program. As a member of a small team, Cliff is responsible for the on-board electronics and Power systems.

The SULE (Swift Ultra Long Endurance) Aircraft is a 72 foot wing span, sub 200lb UAV powered with state-of-the-art Li-S batteries and Solar Cells. The target mission profile is for an over 30-day duration, loitering between 50,000 and 70,000 feet altitudes. A smaller scaled version of the aircraft was also used for flight test and Ground Control Systems training.

Responsibilities included all of the electronics on the aircraft and sub scale test aircraft (batteries, solar, custom PCBs, third party modules, and sensors). Also, the support of ground and flight tests (GCS Flight Engineer). The aircraft has flown two 24-hour flights and reached 67,330 ft.

Cliff did a re-design of the Custom Communications board (data communication and power distribution functions) and it was able to fly on the first release. He also participated in extensive ground testing and numerous successful flight tests at Spaceport, New Mexico and other locations in California.

May 2010 to October 2020
RED Digital Cinema - Principal Hardware Engineer Irvine, CA

As Principal Hardware Engineer, Cliff has been involved with many challenging projects at RED Digital Cinema. His responsibilities include electronic circuit design, oversight of the circuit board and flex designs, and providing support for the Mechanical, Thermal, and Agency Compliance teams.

The Epic and Weapon Cameras were designed as a modular system. The camera body (brain) can be configured to suit the specific application by adding one or more modules. The modules have various power, video, audio, and control inputs / outputs. Cliff was the architect of the power systems on the many of the products.

Epic Camera System (DSMC1)
- Epic Side Handle – Responsible Engineer
- REDmote – Responsible Engineer
- Dual Battery Module – Responsible Engineer
- Quad Battery Module – Responsible Engineer
- Quickplate Module – Responsible Engineer
- XL Battery Plate – Responsible Engineer
- Meizler Module – Responsible Engineer

Weapon Camera System (DSMC2)
- Power System Architect
- RVXL Module – Responsible Engineer
- Gold Mount Battery Module – Responsible Engineer
- V-Mount Expander – Responsible Engineer
- RVXL Module – Responsible Engineer
- Pro Expander – Responsible Engineer

Crimson Laser Projector
- Power supplies – Responsible Engineer
- Safety Interlocks – Responsible Engineer
- TEC Controller Circuit – Responsible Engineer

Manifold – Facebook VR Camera (x16 8k sensors) – Base Unit and Head Unit
- Power System Architect
- Head Unit Power Board – Responsible Engineer
- Safety Interlock Architect

Komodo Camera System
- Power System Architect

Panavision DXL
- Power System Architect
- External Modules for Aux Power and Lens Motor Control – Responsible Engineer
- Supported PV Engineers on their external Modules (FIZ and Hot Swap)

Cliff was the in-house Engineer responsible for the following products (worked with third party manufacturers).
- AC/DC Power Adapter
- RED Brick Battery
- RED Brick Charger
- REDVOLT and REDVOLT XL Batteries
- Travel Charger
- Quad Charger
- REDVOLT-V Battery

November 2009 to Present
Generation 3 Engineering, LLC - President / Consulting Engineer San Clemente, CA

Professional Digital Cinema Cameras and accessories – Cliff started as a consultant at RED Digital Cinema in 2009, working on the Scarlet 2/3 Fixed Lens Camera. As Hardware Lead, his responsibilities included architecture of the power system for the camera brain, modules, and accessories, board level design, and oversaw the layouts for all of the PCBs and flex circuits in the camera. The PCB's were up to 24 layers and had multiple high-speed data paths (XAUI, SATA, PCIe, HDMI, USB, etc.). The mechanical and thermal requirements were extremely challenging. Cliff provided support to the mechanical and thermal teams.

USB Type-C Connector Development – Cliff worked with a major off-shore manufacture that was heavily involved in the development of the USB type-C specification. USB Type-C requires embedded electronics in the connector shell. Cliff was responsible for the Printed Circuit Board design on the very first connector to pass USB Type-C certification.

Small Bluetooth Based Inertial Sensor for Cerebral Palsy Screening of Pre-mature Infants – Cliff worked with a local company funded with grants from the NIH. Meant to be attached to the infant's hands and feet, the self-contained sensor (with coin cell battery) was just 17mm dia. x 10mm height. Cliff was responsible for all of the electronic circuit design, mechanical design, and Printed Circuit Board layout.

Surgical Laser Safety Device – These devices function as a safety interlock device for surgical lasers used in urologic and vascular applications. This relatively inexpensive device prevents damage to the very expensive laser equipment by monitoring an optical detector and quickly shutting off the laser when a fault is detected. The system was designed to be very versatile and work with laser systems from different manufacturers. The electronic design included microcontroller hardware (with internal A to D converter), power supplies, analog signal conditioning, Real Time Clock and non-volatile memory (serial EEPROM). Cliff was responsible for all of the electronic circuit design, firmware design, and Printed Circuit Board layout.

Underwater Communication Device – This was an in-house project at E-M Designs that continued after Cliff left the company. Similar to a pager, this wrist mounted device is used by a scuba diver to signal other divers. The alerts could be sent to a dive buddy, dive master, group of divers, or boat. Data transmission was achieved using ultrasonic technology. A single transducer, developed in-house, was used for both transmission and reception. Cliff personally designed the entire system including the system architecture, communication protocols, analog and digital circuit designs, microcontroller hardware and firmware, power supplies, ultrasonic transducer drive, receiver front end and Printed Circuit board layouts. Cliff also participated in the underwater testing and evaluations of the system.

June 2009 to November 2009
Iris Technology Corporation
Senior Electronic Engineer Irvine, CA

Business was slowing and E-M Designs' EE Group was forced to cut back in June of 2009. At that time Cliff took a full-time position with this former customer, Iris Technology Corp. Iris is a premier integrator of reliable tactical military power systems and supports commercial and strategic space operations with electronics and electro-optics systems.

Cliff's work with Iris spans 2 decades as a consultant, first with Gerhard Engineering and later with E-M Designs. During this recent full-time employment, he continued to provide engineering support for Iris' line of military radio power adapters and solar power products.

More notably, he played a key role in the design and successful demonstration of an electronic control system for an advanced 2-stage Stirling/Pulse Tube Cryocooler. The system includes sophisticated vibration control that requires a high-fidelity drive signal. The motor drive was a modular design with six identical drive cards, each capable of delivering a high-fidelity sinusoidal drive at up to 500W of power at over 90% efficiency. Cliff was responsible for the design of the H-bridge drive electronics and participated in the successful demonstration of the prototype system at Raytheon Space and Airborne Systems. Temperatures of under 20°K were achieved at the second stage.

May 2001 to June 2009
E-M Designs, Inc. - Director – Electrical Engineering Group Dana Point, CA

In May of 2001, Gerhard Engineering, Inc. was purchased by E-M Designs, Inc. and became E-M Designs, Inc. - EE Group. At that time Cliff left his position at CMD Technology to take the position of Director / Lead Consultant. He left on good terms and in fact, CMD was one of the new group's first customers.

Cliff's responsibilities include Electrical Engineering and management of the EE Group. Cliff has been the lead Engineer on several very interesting and challenging projects. The following are some examples:

Smart DC Power Supply – This system was a Lithium Ion (Li-$FePo_4$) battery backed DC power supply and rapid charger for use in medical computer carts. Cliff was the leader of the design team and was personally responsible for all of the hardware design including analog and digital circuitry, microcontroller hardware, thermal design, and PCB layouts. He was also responsible for mechanical design support (solid modeling in SolidWorks) and management of the firmware and software application development.

Medical Electronics – Cliff has participated in multiple research programs for a local medical electronics company. This was another relationship that spanned more than 15 years. He has been personally responsible for the design of EEG monitoring circuits that pushed the state of the art in tolerance to high electrode impedances. These devices include high channel count, high speed, analog multiplexers and Analog to Digital Converters.

In addition to hardware design of REG, EEG, and EKG circuits, he was also involved with system evaluations during clinical tests in the operating room and neo-natal ICU facilities of several local hospitals. Cliff has completed other designs relating to these systems that include Photo Plethysmograph, Galvanic Skin Response (GSR), and Impedance Pneumograph circuits.

Amusement Park Attractions – These designs included several multi vehicle remote control systems. The basic systems consisted of up to 21 Helm stations, a central RF transmitter (900MHz), and 21 Decoder / Receiver boards mounted in the vehicles. Cliff personally designed the entire system including the system architecture, RF design, communication protocols, analog and digital circuit designs, microcontroller hardware and firmware, and Printed Circuit board layouts. The first systems were delivered in 2001 and they are still being produced and used today.

Emergency Vehicle Siren – This was a prototype of a 200-Watt, dual output siren with high frequency switching audio power amplifier. The prototype system consisted of a high-power switching DC/DC converter (125kHz) with custom magnetics to supply power to the two channel (100 Watt each) switching audio power amplifier. Thermal management was one of the greatest challenges for this design. Cliff was a member of the design team and was responsible for the microcontroller hardware and initial firmware design, analog circuitry, thermal design, and PCB layouts.

Automated Test System – Cliff was a member of a team that designed a test station for component used in the National Missile Defense Program. This system consisted of a rackmount industrial computer with a National Instruments data acquisition system and a custom electronics rack that was capable of controlling 15 servo actuators for burn in tests. The systems were also used to automate acceptance testing and documentation of the test results. Cliff was responsible for all of the custom electronic circuit design, power sub-system, electronics card-cage design, and printed circuit board layout.

AC-DC Power Supply for the Single Channel Ground and Airborne Radio System (SINGARS) - These devices were small AC/DC power supplies that were packaged to emulate the Lithium Batteries used on the SINGARS radios. The device is to be used when AC power is available to save the expense of batteries and disposal. This was a very compact package that also included a small Sealed Lead Acid Battery to supply the radio in the event of short duration power failures. This has evolved into a family of products that fit several different radios.

March 1999 to May 2001
CMD Technology, Inc. - Technical Manager – Power and Packaging Group Irvine, CA

Business slowed at Gerhard Engineering and in 1999, Cliff took a full-time position as Technical Manager of the Power and Packaging Group at CMD Technologies, Inc. (a prior customer of Gerhard Engineering). CMD was a leading manufacturer of RAID Controllers and Semiconductors.

In this position, he was personally responsible for all analog / power circuit designs for the company's line of storage products. These designs included the power system architecture for a number of RAID controllers. The circuit designs included hot swap circuitry, power sequencing, multiple high frequency switching DC to DC converters, and battery backup systems.

The following are some design examples:

Hot swappable power subsystem for OEM RAID products – Cliff was responsible for the design of Power distribution and redundancy on the company's Titan and Dakota RAID Products.

RAID controller board - 5 power zones (+5V, +3.3v, +2.5V, +1.85V, +1.5V), high frequency switching DC/DC Regulator circuits, soft start and current limit circuitry, power sequencing circuitry, power zone monitoring circuitry, on board power supply margin testing circuitry.

NiMH Battery Subsystem – This battery back up scheme was intended to supply power to DIMM memories. The high-speed memories require a large supply current (1.5A) when operating and a small current when in standby mode. The system required that a large amount of memory be transferred prior to a system shutdown or power failure. The memories required a "glitch free" transition to battery power at the time of power fail or brown out. This was accomplished using parallel switching regulators. A microcontroller-based charging circuit was also part of this design.

Cliff was also responsible for the selection of the company's PCB Layout tools (Veribest/Mentor). CMD's PCB designs featured large dense boards, with fine pitch surface mount and BGA packages, high frequency interfaces including LVD SCSI, 1GHz Fibre Channel, ATA, IDE, and 100-Base T Ethernet. Cliff was responsible for the design of PCB stack-ups to handle the complex impedance control and signal integrity issues.

March 1984 to May 2001
Gerhard Engineering, Inc. Mission Viejo, CA
President / Consulting Engineer

In 1984 Cliff left Data Chron because the demands of the job were making it difficult for him to make adequate progress towards his degree. He joined Gerhard Engineering (his father's consulting business) and continued taking classes at night.

The following list is a brief sample of some of the more important projects Cliff was responsible for during his time at Gerhard Engineering:

Medical Electronics

32 Channel Rheoencephalograph (REG) System (Bio-Impedance)
32 Channel Portable EEG
72 Channel EEG
Bio-potential Measurement Circuits (EKG, EMG, etc.)
Galvanic Skin Response (GSR)
Impedance Pneumograph
Photo Plethysmograph

Designs for Spacecraft FPA (focal plane array) front ends and data acquisition circuits for the following Programs:

Delta Star	– Engineering Support / Printed Circuit Design
Mars Observer Camera	– Engineering Support / Documentation
AIT	– Team Leader – Analog Front End
SIBIRS	– Team Leader – Power Supplies / Digital Controls
TES	– Engineering Support / Printed Circuit Design
CrIS	– Engineering Support / Printed Circuit Design

Requirements for these projects included Mil-883B compliance, radiation hardness (for low earth orbit), and redundant circuitry.

Automotive Products

Microprocessor based Sirens / PAs
Shotgun lock controller
Light Bar controller
RF collision avoidance system
Ultrasonic collision avoidance system
Microprocessor based fuel injection cleaning system
MBZ diagnostic tools

P.C. Peripherals

10/100 base T Network cards
Video Cards
Riser Cards (100+ designs including Intel's NLX Reference Design)
PCMCIA / Cardbus Host Adapter

Telephony

DTMF Remote Control with Digital Voice
Telephone Line Interface (FCC Part 68 compliance)
Digital Audio Systems

October 1979 to March 1984
Data Chron, Inc. Tustin, CA
Chief Engineer

Data Chron Inc. manufactured time code products for use in the aerospace industry. Cliff started as an entry-level technician and eventually became Chief Engineer. As Chief Engineer, Cliff was responsible for all new designs and their development through production. His responsibilities also included project scheduling and management of the production test department.

A list of some of the products designed by Cliff:

Count Down System / Time Code Generator for Kwajalein Missile Test Range
Count Down System / Time Code Generator w/ 1 PPS Digital Phase Lock Loop
DR11-C Computer I/O
RS-232 Computer I/O
IEEE 488 Computer I/O

Early Experience Anaheim, CA

Cliff's first technical experience was gained working with his father, Frank, while in junior high school. He learned to solder and work with electronic components. He also learned about printed circuit board design and helped with revisions and check out of tape and mylar artworks. This part time work with his father continued through High School.