

# Curriculum Vitae

**CLIFFORD B. GERHARD, P.E.**

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Cliff Gerhard is a licensed Professional Engineer (California License # 14447) and is currently President and Chief Consultant at Generation 3 Engineering, LLC.

Cliff is a third generation Electrical Engineer with more than 30 years of technical experience. The majority of this experience was gained working as a consultant. For 16 years he worked with his father, Frank Gerhard, a pioneer in the field of electronics. 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 has to take on jobs in areas that are outside their comfort zone. This results in a very wide base of experience. They must be able to quickly and accurately judge the feasibility of a proposed project and give the customer an honest assessment, even if it means losing the business opportunity. 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 25 years is an indication of Cliff's abilities and how he was able to keep his customers happy and coming back.

Cliff has produced designs used in medical instruments, spacecraft, aircraft, automobiles, motorcycles, emergency vehicles, industrial control, computer products, test equipment, telephony, communications, 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 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.

Cliff purchased Wintek's smARTWORK program for Gerhard Engineering in 1984. smARTWORK was the first printed circuit layout software ever released for the IBM Personal Computer. He created and launched Gerhard Engineering's web page in not long after the internet first went commercial in 1995.

## **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 in 1990:

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 in 1991. 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 in 1993, again passing on his first attempt. In the 1993 exam, 28% of those who took the test received a passing score.

## PROFESSIONAL EXPERIENCE

**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 with RED Digital Cinema, 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. He participated in design oversight 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.

**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.***

Dana Point, CA

Director – Electrical Engineering Group

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<sub>4</sub>) 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.***

Irvine, CA

Technical Manager – Power and Packaging Group

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 in the early 1970s. 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.