Duncan G. Cumming, Ph.D. (Camb.)

Expertise

- **ITC Experience**
- Power Supplies
- Electronic Hardware
- Embedded Control Systems
- GPS Systems
- Joystick Design (Games)
- RF Systems

Professional Summary

Dr. Duncan G. Cumming, Ph.D. (EE, Cambridge University, England, 1979) is the president of Emmanuel Avionics, Inc at San Pedro, California. He has been in the business of electronic design since 1979. Dr. Cummings' core business is the design of electronic controls for the Unmanned Air Vehicle (UAV) market, including inertial measurement, autopilots, electrical power controls, RF systems and video technology. These technologies are mostly applicable to the civilian market, although some UAVs do have military applications. Dr. Cumming has a wide scientific background, and is able to provide expert testimony and assess both the performance and the newness of various technologies. While this is primarily useful in Intellectual Property disputes, it has occasional applications in other types of cases.

Employment History

From:	1996	**Emmanuel Avionics, Inc.**
To:	Present	San Pedro, CA
	Position:	*President – Electronic hardware consulting.*
From:	1984	**Cambridge Electronic Design, Inc.**
To:	1996	San Pedro, CA
	Position:	*Chief Executive Officer – Electronic hardware consulting.*
From:	1982	**Unified Technologies, Inc.**
To:	1984	Los Angeles, CA
	Position:	*Senior Systems Design Engineer. Designed video game software and CRT display system.*

From:	1979	**Hughes Aircraft Co.**
To:	1982	Los Angeles, CA
	Position:	*Member of Technical Staff – commissioned electron beam microfabrication system*

From:	1979	**Cambridge University Engineering Dept.**
To:	1979	Cambridge, UK
	Position:	*Postgraduate Research Student – Researched revolutionary new e-beam imaging system.*

Consulting History

Dr. Cumming has a wide range of expertise acquired over the years. Clients have included everything from one man operations to Fortune 500 companies. Some of the major clients are shown below:-

From:	1984	**Client:- Aero Vironment, Inc.**
To:	Present	Simi Valley, CA
	Duties:	Design and construction of numerous electronics packages for unmanned air vehicles. **Embedded Control Systems** including Atmel and Motorola. Experienced using Integrated Development Environments. **Switched Mode Power Supplies.** Over the years, Dr Cumming has worked on a wide variety of switched mode power supplies. From computer card supplies (5V) to high voltage (30kV), and some exotic supplies with input voltages of less than a volt. He has used most supply topologies at one time or another, for boost mode, buck mode and both. **RF Systems** including receiver design, video transmitter design, digital control systems and radio modems. **Transducers** including **accelerometers**, integrated gyros, conventional rate **gyros**, pressure transducers, **strain gauges** and **magnetometers**. **Inertial Measurement Units (IMU).** Both design from scratch, and utilization of commercially available units. **Unmanned Air Vehicle Design,** including both fixed wing and rotary types, on all scales from 6 inch wing span to 270 feet.

From:	1983	**Client:- Hughes Aircraft Co**
To:	1984	Torrance, CA
	Duties:	Enhancement and maintenance of electron beam microfabrication system. **Magnetic Deflection Systems**. High resolution deflection systems for electron beam microfabrication, raster mode and vector mode deflection systems for cathode ray tubes, and one combined system that did both raster and vector deflection simultaneously.

From: 2009 **Client:- Sage Cheshire, Inc**
To: 2010 Lancaster, CA
Duties: Design and construction of space suit chest pack for Red Bull Stratos high altitude parachuting record attempt.
Global Positioning System. Selection and interfacing of suitable GPS receivers for a large variety of tasks, including supersonic speed measurement using civilian GPS receivers.

From: 1986 **Client:- Applied Research Associates, Inc.**
To: 1989 Albuquerque, NM
Duties: Design and construction of numerous electronics packages for 70 foot unmanned surveillance blimp.
Video Camera control systems. Pan/tilt units, gyro stabilized camera mounts.
Autopilots. Dr Cumming has designed autopilot systems for fixed wing, rotary, blimp, and balloon systems.
Infra Red, Visible Light, and Low Light video camera systems.

From: 1984 **Client:- Other**
To: Present
Duties: Electronic Hardware Design Projects
RF design for underground pipe detection, metal detection, and other low frequency (VLF) applications.
Joystick Design and human factors engineering, including force operated joysticks, programmable joysticks, and "use in the air" joysticks (i.e. not connected to any fixed object).
Pneumatic Control Systems. Automatic braking and throttle control systems. Investigation of "sudden acceleration" problems.
Autonomous Vehicle Design. Dr. Cumming developed the interface units for a vehicle that entered the DARPA Grand Challenge, a government sponsored unmanned ground vehicle competition.
Rocket Payload Systems. Both sub-orbital and near-space systems.
Power Electronics. Dr Cumming has designed 400Hz harmonic reduction systems for the Boeing 747 aircraft, high power oscillators (1MHz, 10kW), motor control systems, and heater control systems.
Magnetic Levitation Systems. Dr Cumming has designed everything from a simple overhead solenoid system to a complete levitation system operating entirely from below a flat table top, with no visible sensors.
High Voltage Pulsed Systems. Dr Cumming has worked with a 10kV, 3Amp, 50nS pulsed system for field emission cathodes.
High voltage DC systems. Dr Cumming has worked with a number of high voltage control systems in the electron beam microfabrication industry, up to 30kV. He is also familiar with the use of **thermionic tubes** in such control systems, one of the few surviving uses of the thermionic tube today.

Vacuum Systems. Dr Cumming has experience with both diffusion pumped high vacuum systems and ultra high vacuum ion pumped systems. He has worked with tungsten, LaB_6, and field emission cathodes and the associated high voltage equipment.

Litigation Support Experience

Date:	1996	
	Case	Cambridge Electronic Design, Inc.
	Project:	Testified as the defendant in a contractual dispute with Cambridge Electronic Design, Inc. This involved a successful petition to compel arbitration in superior court, and testimony (using telephone conference calls) for the ensuing binding arbitration.
	Status:	Case closed, no damages awarded.
Date:	2010	
	Matter	International Trade Commission Action
	Project:	Acted as a Consulting Expert Witness in a patent validity case involving power supplies.
	Status:	My involvement complete, but case ongoing as of Oct, 2010
Date:	2011	
	Matter	International Trade Commission Action
	Project:	Acted as a Testifying Expert Witness in a patent validity case involving marine autopilots.
	Status:	Case settled on favorable terms following my testimony at deposition.
Date:	2012	
	Case	Product Liability Case – Superior Court Of The State Of California
	Project:	Acted as a Testifying Expert Witness against a luxury automobile manufacturer in a product liability case involving an automotive braking system.
	Status:	Jury verdict against the auto manufacturer in March, 2012.
Date:	2012	
	Matter	International Trade Commission Action
	Project:	Acted as a Testifying Expert Witness in a patent validity case involving hand held computers.
	Status:	Case dropped prior to first deposition.
Date:	2012	
	Matter	Patent Infringement Case – Delaware District Court
	Project:	Acted as a Consulting Expert Witness in patent validity matters involving LCD displays and docking computers.
	Status:	My involvement complete, but case ongoing as of October, 2012

Patents

Patent Number	Date Issued	Title
7013.001	May 24, 1996	Cordless Free Floating Joystick (Provisional)
13/741,558	Pending	Method For Generating Tidal Energy Utilizing The Scalar Gravitational Potential of Celestial Bodies.

Education

Year	College/University	Degree
1979	Cambridge University, England	Ph.D., Electrical Engineering
1978	Cambridge University, England	MA
1974	Cambridge University, England	BA

Publications

Cumming, A.D.G. "A Method For Determining The Geometry Of Field Emitters" Optik, **49** No.1 (1977) 17-23.

Bishop, J.F., Cumming, A.D.G., Ferrari, R.L., Miller K.J. "Cambridge University Vatnajokull Expedition, 1977" Polar Record, **19** No. 118 (1978) 51-57.

Cumming, A.D.G., Smith, K.C.A. "Energy Spread And Fluctuations In Field Emitted Electron Beams" Microcircut Engineering ed. H. Ahmed, W.C. Nixon © Cambridge University Press (1980) 575-579

Cumming, A.D.G. "A High Speed, Noise Tolerant Edge Detection Algorithm Using A Low Bandwidth Signal Chain for E-Beam Registration" Microcircuit Engineering (Feb 1981)

Cumming, A.D.G. "A High Performance, Low Cost, Isolated Electron Current Amplifier" Scanning © G. Witzstrock Publishing House Inc., 2, (1979) 104-109

Professional Associations and Achievements

- Member, IEEE
- Fellow of Cambridge Philosophical Society