



# AEROSPACE CONSULTING

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## Edward S. Troy

RF, MICROWAVE, ANALOG DESIGN	ELECTRONIC WARFARE
SYSTEM DESIGN AND ANALYSIS	CIRCUIT ANALYSIS / OPTIMIZATION
DIRECT DIGITAL SYNTHESIS	LOAD-PULL MEASUREMENTS
TELEMETRY EQUIPMENT	LOW-NOISE AMPLIFIERS
POWER AMPLIFIERS	BROAD-BAND AMPLIFIERS
VCO's	SYNTHESIZERS
TRANSMITTERS	FCC COMPLIANCE / PRE-COMPLIANCE
RECEIVERS	MICROSTRIP ANTENNAS
DETECTORS	CIRCUIT BOARD LAYOUT
WIRELESS DEVICES	DESIGN TROUBLESHOOTING
FILTERS	SOFTWARE DEVELOPMENT
AVIONICS	MODULATORS
GPS APPLICATIONS	SPREAD-SPECTRUM EQUIPMENT
TECHNOLOGY EVALUATION	LITERATURE RESEARCH/ RETRIEVAL
EXPERT WITNESS	DSP APPLICATIONS
TECHNICAL WRITING	EMBEDDED C PROGRAMMING
FPGA DEVELOPMENT USING VERILOG	PROPOSAL CONSULTING / ASSISTANCE

Edward Troy is an electronics engineer with over 34 years of experience in RF, microwave, wireless, and analog circuits and systems. His strong background in engineering, from both a design and a production point of view, as well as his practical knowledge and formal education in the fields of engineering, business, and marketing, allow him to assist engineering and management to achieve their program and corporate objectives. Furthermore, by receiving his Master's degree in Electrical Engineering 22 years after receiving his BSEE, and performing Ph.D level research after receiving his Master's degree, he has kept his education and technical knowledge in the field current. He is interested in putting his knowledge (and/or facilities) to work for clients who require technical assistance, or consulting advice, on any programs that may be proving difficult to properly staff with internal personnel. He also performs work for clients who need independent circuit or system design, development, analysis, prototyping, and troubleshooting. Many clients have also found his expertise in high speed analog, RF, and microwave circuit board layout to be very useful in helping them to rapidly turn their ideas and schematics into working circuits and systems. Although he has his own facilities, he is also available for consulting at sites almost anywhere in the world on either a long or short-term basis.

## EDUCATION

Ph.D. level research in electrical engineering at Lehigh University performing dissertation research in the area of nonlinear semiconductor and system modeling, as well as in the area modulation distortion, prediction, and analysis.

Master degree in Electrical Engineering at Lehigh University - 1997

Graduate courses in the MBA program at Lehigh University 1978 - 1982

B.S. Electrical Engineering, College of Engineering, Lehigh University - 1975

Continuing education courses in spread spectrum systems, microwave circuit design, and thick-film hybrid circuit

technology.

## EXPERIENCE

### **Aerospace Consulting, PO. Box 536, Buckingham, Pa. 18912 (1989- Present Full time - 1983 - 1989 part-time)**

Owner

Designing and developing wireless, analog, RF, and microwave circuitry for various clients operating at frequencies ranging from DC to over 18 GHz. Design and development work has been heavily based on computer circuit simulation and optimization using the latest linear and non-linear circuit design and analysis tools. Circuitry developed or worked on includes high power pulse DME amplifiers, several 900 MHz synthesized transceivers for commercial spread spectrum applications, 225-400 MHz synthesized transmitter, 225-400 MHz 100 watt amplifier, DDS circuits, various lumped and distributed filters, detectors, switching circuitry, low-noise VCO's and synthesizers, low-noise amplifiers, cellular base station receivers, low-power synthesized industrial transmitter, microstrip patch and helical antennas, C and X band transverter, and some unique GPS circuitry. Other work has included performing independent design evaluation and production trouble-shooting for several clients, S-Band telemetry transmitter proposal assistance, GP-IB test equipment programming, system control and test software development using Visual Basic, development of Xilinx FPGA's using Verilog, and embedded microprocessor programming using C, assisting with FCC compliance, RF susceptibility evaluation, low-cost satellite receiver design, as well as double-sided and multi-layer circuit board layout using P/CAD and ACCEL software for many of the design and development programs mentioned above and for various clients. Extensive work was performed as a principal designer for a major military broadband electronic warfare jamming system. Ed was also a major contributor on a team tasked with putting together a proposal for a major military high capacity digital microwave radio, as well as another team putting together a proposal for a wireless internet system. Ed also has extensive experience with literature search, research, and retrieval, for various technical and mergers and acquisitions projects, including a study of the state of the art in antenna design, development, and technology. Other work has included extensive design, development, and prototyping of 900 MHz and 2.4 GHz FCC Part 15 circuits and systems, various GPS-related applications, as well as the evaluation and testing of various low-noise amplifiers for cellular systems and the evaluation of cellular tower coverage. Some recent work has involved working, both for an extended time at a client's location, as well as in my own laboratory, on designing and developing a new, ultra-miniature telemetry transmitter using FQPSK (Fehrer-patented QPSK), as well as work on a GPS translator. These, and other recent designs featured very low phase noise fractional-n synthesizers. Other recent system and circuit design and development has included designing, developing, prototyping, and now cost reducing, the RF and microwave portions of a radar-like body scanning system. This work included all of the frequency generation, upconversion, and downconversion over a frequency range from DC through lower Ka band.

### **Agilis Corporation, Digital Radio Division, Langhorne, Pa. (1988 - 1989) Senior Member, Technical Staff -**

Responsible for design and development of amplifiers and T/R switches for a FCC Part 15 spread-spectrum modem. These designs included both receiving and transmitting amplifiers operating in the 900 MHz band, as well as the necessary switches and power level shifting circuitry. Other work included circuit board layout and system integration, as well as initial manufacturing coordination and surface-mount vendor selection.

### **ICI Americas, Valley Forge, Pa. (1982 - 1988) Senior Electronics Engineer-**

Responsible for all microwave and RF electronics activities within the Aerospace Division. Activities included design and development of microwave circuits and microstrip antennas, as well as the coordination of outside microwave and hybrid circuitry design and development. Systems developed included transmitters and receivers operating between 800 and 1900 MHz. Circuitry developed included low noise amplifiers, synthesizers, modulators, microstrip filters, and IF sections. Other responsibilities included selection and establishment of an IBM PC based electronic CAD facility, as well as establishing, and training technicians to use, a printed circuit board facility capable of going from computer-

generated artwork to printed circuit boards in less than 6 hours. Additional work included the successful identification of an acquisition candidate for ICI Americas.

### **United Technologies Corp., Tele-Dynamics Division, Fort Washington, Pa. (1978-1982) Senior Engineer**

Responsibilities ranged from leading an engineering team tasked with taking several complex military telemetry transmitters from the development phase into the production phase, to design and development of an S-Band video transmitter. Other activities included research, development, and the writing of technical proposals, as well as the design and development of amplifiers, multipliers, and modulators for telemetry transmitters.

### **American Electronics Laboratories, Colmar, Pa. (1975-1978) Electronics Engineer**

Responsible for design, development, production, and testing of RF components that operated at frequencies ranging from 2 to 18 GHz. These components included video detectors, limiter/detectors, and couplers in both microstrip and stripline. Other work included the development of test stations and programs to allow for the automated testing of microwave components through the IEEE-488 bus.

## PUBLICATIONS .

Article in June, 1992 issue of RF Design magazine on the Global Positioning System

Cover feature in September, 2003 issue of RF Design magazine, "Highly Spectrum-efficient Modulation Techniques and Other Technology Advances Take Hold in Aerospace Electronics".  
[http://mobiledevdesign.com/images/archive/309RF\\_Troy24.pdf](http://mobiledevdesign.com/images/archive/309RF_Troy24.pdf)

## **Facilities**

Although I am certainly available to work at a client's location, for short or long periods of time, anywhere in the United States and in many other places in the world, that is usually not necessary, since I have my own facilities. These include many of the most popular software packages such as Genesys, SystemVue, Intusoft Intuspace, Accel P/Cad and Altium Designer for circuit board layout, Matlab, Mathcad, Mathematica, Visual C++, Visual Basic, Visual Fortran, NEC/4, EZ-NEC/4, HT-Soft PICC C compiler, MPLab IDE, Cam 350, and Xilinx Foundation for FPGA development in Verilog, among others. I also have a complete suite of test equipment for RF, analog, and digital design and development including an HP-8563E spectrum analyzer covering 30 Hz to 26.5 GHz which has both the phase noise measurement personality as well as the spurious measurement personality. I also have an Agilent 8510C vector network analyzer, with the time domain option, that covers 45 MHz to 26.5 GHz. In addition I have an Agilent 8753D with the time domain and high stability options, covering 30 kHz through 6 GHz. For measuring noise figure, I have an Agilent 8970B and 8971C with a 346C noise source. This combination covers 10 MHz through 26.5 GHz. Other equipment includes an Agilent E4433B RF signal generator covering 100 kHz – 4 GHz with the dual arbitrary waveform generators and other options for generating all sorts of digital modulations such as GMSK, TDMA, CDMA, etc. Other equipment includes a TEK TDS-744A 4 channel, 500 MHz, 2 GSps digital oscilloscope, a 33 GHz Agilent 4 channel digital oscilloscope, and an Agilent 33220A arbitrary waveform generator. Additional equipment includes a 600 MHz analog oscilloscope, a scalar network analyzers, various signal generators covering DC to 26.5 GHz, and RF test equipment such as stub tuners and slide screw tuners (for tuning and load-pull testing), loads, attenuators, switches, and directional couplers. I also have a small milling machine for machining boxes and pallets for various RF components. New test equipment is constantly being added, as needed.

References available upon request.