**Craig Arno** **206-203-5630 voice** **craig@arno.com**
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## EDUCATION
University of Washington **–** BSEE and a lifetime of passionate engineering experience

## KNOWLEDGE AREAS
Commercial product design in DO-178B, and CFR 21 Part 820 high reliability design environments, Communications, IPv4 networking, Linux/LAMP, Medical Ultrasound, Heart Monitoring and Defibrillation, Non-invasive blood pressure measurement, manufacturing automated test.

## SKILL SUMMARY
- *Hardware:* Designed, developed, analyzed board electronics for high performance medical applications. Designed and developed microprocessor hardware/firmware for medical applications. Environments include Altium Designer 17, Circuit Studio 1.4, Eagle CAD 7, Xilinx ISE 14.7, OrCAD CIS (Windows), Viewlogic Powerview (Sun OS), EIA RS-232 serial, PCI 2.2 bus
- *Software Development:* Experienced in C/C++, Design Patterns, Atmel ASF, Atmel assembly, Python, Doors DXL scripting, ARM 7, Windows, Linux, uClinux, VxWorks, microcontroller programming with tools such as Visual Studio, GNU C, GDB with DDD, MS Excel/Word Macro. Solid understanding of overall software development processes. Also, experienced with software CM processes and tools such as GIT, Subversion (SVN), ClearCase, WebIssues, Perforce, JIRA, ClearQuest and Linux/Unix/Windows development, integration environments. Linux Admin (development) with a 30+ device IP network for 15+yrs, QoS, VoIP, embedded remote debug (DDD), Wireshark, Asterisk, numerous other tools/applications too large to list.
- *System Development:* As an engineering lead, participated in the design and development of a Win2K based high-end ultrasound system, and development for a 22K line C/Assembly based automated test system. DOORS, ARINC 615A
- *Program Management:* Project lead for several embedded applications/features. This involved requirements gathering and analysis, task breakdown and management, scheduling, implementation, integration and verification.
- *Technical Writing/Proposals:* Authored numerous technical documents including: software architecture/high-level designs, hardware specifications, user's manuals, data analysis reports and process documents. MS Office, LibreOffice/OpenOffice, FrameMaker tools.
- *Personnel Management:* Developed excellent organizational, communication and personnel management skills while mentoring engineers, supervising personnel and managing projects.

## PREAMBLE
*Craig comes to us with over 30 years of experience in hardware design and verification. His main area of expertise is design though he has a broad skill set within electrical engineering. Currently, Craig is not working and teaching himself how to use Altium tools. He also presents at the IPC Designers Council for PCB Designers and attends regularly to continue his education and expand his skills. Here is why you will want to interview Craig:*
- *Although, he has not worked in a little over a year – he still maintains his skills and keeps them fresh (see above). At his last assignment he started in software and then was moved into focusing on hardware. The environment was very reactive so he would work on a variety of tasks every week including analysis, high speed redesign, performing design changes, software design and more.*
- *Before that he was brought in to the Living Computer Museum (Paul Allen's Computer collection), to fix an IBM 360 mainframe from 1960 – get it up and running. During this short project, he had to redesign the entire lighted console using Eagle for schematic and board layout. He also implemented other high speed*

*interfaces into the system.*

- *Throughout his career, he has worked in many regulated industries including aerospace (Honeywell and Sagem Avionics) and medical devices (Siemens, Physio-Control and EKOS). He also has his own company called Stepwise Solar – which he has intermittently focused, as well. While at Siemens, he focused on ultrasound high speed circuit design – he would also do some analysis and debugging as well. At Physio, he specialized in test design – creating a variety of tests that are most likely still used today.*
- *He is not an analog/digital expert but has experience working in these areas. His electrical design experience is vast and he is confident his ability to come in and positively impact the team. – he can interview and start immediately.*

## RELATED EXPERIENCE

**Lake Washington Institute of Technology**
20 September 2017

- Produced and delivered a presentation "DDR2 Design Analysis, On Ramp to High Speed Electronic Design" in conjunction with IPC Designers Council to industry professionals.
- Transmission line model of PCB gap
- SPICE model of transmission line solution
- IBIS model used in Signal Integrity simulation
- Summary conclusion with scope image measurements to support modeling behavior.

**Study Altium Designer / Circuit Studio (Purchased License)**
May – September 2017

- Circuit design (focus on High Speed signals)
- Circuit simulation
- IBIS Modeling
- Component selection Vendors, Altium Vault
- SVN Version Control in a multi-user environment
- 3D modeling
- Touched on PCB Layout
- Component Libraries, databases, and more...

**EKOS**
November 2015 - May 2016

- Performed stripline/transmission line analysis for 400MHz DDR2 ARM PCB transmission loss estimation
- XJTAG implementation and coverage using Altium Designer
- I2C/SMBus redesign for Lithium Battery pack
- Analyzed Lithium Battery pack electronic design changes for IEC 62133-2012 recommendation
- Improved DFT while analyzing 120W Boost Switching DC-DC Supply
- Update SW Architecture Design Pattern and State Diagram documentation
- Used Perforce revision control, bug tracking, and WebIssues bug tracking.
- Debug C/C++ code in GNU ARM Eclipse based environment
- Introduced OOVAIDE C++ analysis IDE tool to EKOS development environment.

**Living Computer Museum**
February 2015-Aug 2015

- Designed LED replacement console panel for mainframe using Eagle 7.3 schematic/board layout hierarchical design. Geekwire Article link (clickable link) Finished assembly is mounted using custom designed 3D MakerBot printed plastic circuit board/lamp holder.
- Implemented Virtual Card Reader mainframe hardware using VHDL in Xilinx ISE 14.7 environment to bridge mainframe electronics to PCI interface for custom PC based C++ app.
- Created VHDL Virtual Card Punch Output electronics using approach similar to Virtual Card Reader.
- Introduced Git SCM into LCM development environment. LCM Design IP storage is hosted in GitLab.
- Developed needed, no longer available IBM SLT/SMS Connectors using Eagle CAD, and 3D printer.

**Stepwise Solar**
January 2012-Nov 2014

- Completed Atmel ASF "Time Critical Applications" and "Low-Power System Design with Atmel MCU, Wireless and Touch Solutions" programming classes using SAM4L and AVR XMEGA-A3BU platforms. Completed Edmonds Community college business course. Setup OpenSUSE 12.2 x64 Linux; Asterisk 11, Postfix email, GIT and SVN revision control, Mantis bug tracking, LAMP stack secured with Apache 2048-bit certificates and SSH on AMD FX-8120 and Phenom T1100 hardware to support expanding engineering hardware/software product development and business infrastructure resource service needs. OrCAD SPICE Modeling and circuit design. Atmel Studio 6 C/C++ development.

**Sagem Avionics**
February 2011 – December 2011

- DO-178B work on the ARM 7 TDMI-S based NIU4X product. JIRA/SVN development environment. Excel macro NIU4X product configuration tool (Motorola S-Record output) to remove need for compiler tools in product sustaining and production. Solid HW background helped with this effort.

**Stepwise Solar**
January 2009 – February 2011

- Phase I - Research for markets, technologies, strategies, requirements, infrastructure. Phase 2 - Design electronics schematic, PCB layout, and C/C++ software for a solar application. Electronics include an embedded Atmel processor for power control electronics.

**MythTV.org**
September 2009

- Assembled, debugged, and installed MythTV HD recorder under OpenSUSE 11.1 x64 on an Athlon 4000+ X2 system using a Hauppauge 2250 Dual channel TV card. This system provides two DTV channels record/view, commercial skip capability, and networked programming for other viewing front-ends on the local network. This system replaces two analog TV Replay 5040 NTSC units on Comcast cable.

**Honeywell**
Redmond, WA – November 2007 through November 2008
- Created system, hardware, and software specifications for weather and traffic radar using DOORS requirements tool. Maintained and enhanced DOORS DXL scripting for daily controlled requirements interchange with overseas partner. My primary focus included system hardware specifications and ARINC 615A-2 Software Data Loader Using Ethernet Interface. Product application is for both military and civilian aircraft. To accomplish this required a team effort with other system and design engineers.

Redmond, WA – June 2007 to September 2007
- Responsible for finding and solving a difficult to repeat embedded system bug causing an Intel processor GP Exception. Task required working with senior staff and significant lab time analyzing Intel bus cycles to locate an Interrupt pragma bug in the commercial C++ compiler used to produce product object code. This design assignment completed successfully after providing technical knowledge used to complete software release documentation requirements in a DO-178B design environment.

**Sonasearch**
Redmond, WA – September 2006 to December 2008
- Complete design of research sonar software for a Windows MFC application for production field use. This task required knowledge of C++, MFC, Hardware design, operating in a multi-threaded environment.

**Honeywell**
Redmond, WA – March 2005 to August 2006
- Development of DO-178B Structural Coverage Analysis Testing Tools for TI TMS320C6713 based product. Development used Microsoft C/C++, Python, and Excel/Word VBA Macro's in a Cygwin environment to accomplish task.

**Independent Study**
Bothell, WA – November 2004 to February 2005
- Xilinx ISE Embedded Development Kit – VHDL 32-bit soft processor system on a Spartan-3 FPGA chip capable of running uClinux with hardware and software debug tool support.

**Infinium Labs – On demand gaming set top box**
Seattle, WA – Contract Project Engineer, May 2004 to October 2004
- Realtime Control Software – Developed security and realtime interface requirements and software code for Atmel ATMEGA32-16PC RISC processor. The project tools were GNU C and AVR native assembly.
- Security and Console Electronics – Complete missing microcontroller and FPGA hardware design. Then integrate existing display drive electronic design with new PC platform design.
- Independent study of Intel south bridge LPC bus.

### Siemens Medical Systems Inc. Ultrasound Group

Issaquah, WA – Contract Engineer, June 1996 to May 2003

- Continuous Wave and Steerable Continuous Wave Doppler Ultrasound – Software feature lead for responsible for ultrasound requirements, design, preliminary schedule, and implementation/code.
- Designed board for high speed 100+ channel A/D capture subsystem. The same board provides stable differential clocks and bias signals for the rest of the system.
- Real-time control of individual ultrasound transmit channels – Developed approach and software to provide functionality in a normally functioning ultrasound machine. This 10-week effort added new user interface and low level hardware control software with supporting requirements documentation to an existing system.
- Responsible for coordinating single board product design. Coordinated efforts of 4 senior design engineers. Performed analysis for board high speed bus designs. Debugged FPGA PCI implementation for a single board product.
- Responsible for introducing and training newly hired software talent to existing product development tools, environment and practices.
- Implemented system wide state save and restore memento pattern using C++. The pattern maintains data encapsulation for an objects internal state while allowing a calling process to later restore an objects internal state.
- Completed implementation and review of FDA regulated Ultrasound transmit power software subsystem.
- Developed a specification to describe an OEM external customer interface for an ultrasound image and screen capture subsystem. The specification was used for in house software development after verifying it met customer needs.
- Enhanced Worst Case Search tool for semiautomated transducer acoustics measurements using Microsoft C++. Updates added specified new functionality and repaired programming oversights. Converted WCS tool to a DLL. Repaired event processing communication across programming space and multithread boundaries.
- Created “CIA Programmers Guide” documentation for on site programmer reference and training.
- Implemented many ultrasound control algorithms to control an ultrasound machine using C++.
- Created TIA-602, Multitech and Hayes modem capability for a VxWorks serial driver in a Motorola 68060 based embedded system. Development environment included the Clearcase revision control system.
- Developed new assembly/C firmware for an embedded ADSP21020 processor. Tests using the firmware are developed in a Motorola 68060 C++ environment under existing proprietary user interface software.

### Independent Study

Bothell, WA – May 1996

- Implemented UNIX sendmail, mgetty+sendfax, diald, dosemu, samba, and mp tools for server use.

Rebuilt UNIX kernel as part of OS upgrade to host Internet mail domain.

### Microsoft Corporation
Redmond, WA – Contract Engineer, April 1995 to April 1996

- Responsible for porting Microsoft Windows NT Hardware Test Certification shell source from Windows NT 3.51 to Windows 95 using MS Visual C++ 4.0. Created Internet distribution package using Install Shield. Maintained test source code control system (SLM) concurrent with the shell programming assignment.
- Developed software and algorithm under Windows NT Advanced Server 3.51 using Visual C++ 2.2 and 1.52. The program provides database evaluation data while developing an algorithm to reduce database size for use in two of the company's products.
- Produced 30 Web Page HTML document tree describing test design and usage. The pages are used by both final customers and the test design team.

### Motorola
Bothell, WA – Contract Engineer, March 1993 to March 1995

- Design Engineer for a Windows mobile computer. High integration achieved using SCAMP II 82C315A system controller. The computer is designed for operation in wide temperature ranges seen in mobile environments.
- Developed GUI software under Windows using Microsoft Visual C++. The program is used for Motorola mobile computer CRT and keypad verification.
- Design support for a 5 inch VGA compatible monochrome CRT assembly.
- CDPD (Cellular Digital Packet Data) System Validation and Verification Infrastructure. Provided test tools, configuration and connectivity solutions in wireless and wired TCP/IP WAN environment for mixed UNIX and MS-Windows environment.
- Designed a circuit to drive 4 VGA monitors from a notebook computer for CRT temperature qualification testing.

### Physio Control Corporation
Redmond, WA – Project Design Test Engineer, February 1983 to March 1993

- Developed an electronic-mechanical simulator device to simulate patient non-invasive blood pressure signals for products in production. Two other engineering teams were unable to obtain closure on this project prior to my assignment. Outside interest caused company to evaluate potential sale of this device as a new product.
- Designed 15K lines of 25K line total mixed C and assembly for a real-time automated production test system. The test system software is used to control and analyze high speed high energy product waveforms and test fixture electronics. The test system performs over 300 tests for each product tested. Final test system validated successfully within schedule. Worked closely with partner senior engineer to integrate independently developed code into the final product.
- Managed six engineers to develop an automated test system for production. The test system is used to calibrate and test a medical product to provide heart therapy and heart measurement.
- Design electronics used for real-time automated calibration and test of high energy small signal medical instrumentation.
- Developed interrupt driven serial RS-232 communication software for automated production test platforms. Solution took the form of a MASM generated DOS INT14 TSR replacing BIOS serial communication function.
- Designed communication link between production test system and VAX computer. Both systems are

heavily used multi-user, multi-tasking computing systems. The link provided datalogging, CAE information conduit for forward and back annotation of CAE designs, spooling, and general purpose file transfer.

- Created Motorola 6805 microcontroller embedded product test code. Tools used; UNIX hosted cross assembler, Tektronix emulator for real-time system debug.
- System manager on multi-user computer. Responsible for computer backup procedures, organizing file system for ease of maintenance and use.
- Developed test case specification in accordance with IEEE/ANSI Std 830-1984, “IEEE Guide to Software Requirements Specifications”.
- Developed a Test Procedure Guideline to ensure Test Procedure compliance with Code of Federal Regulation (CFR) 21 Part 820 “Good Manufacturing Practice”.