MEGGITT (OECO)

- Samuel Dorning
- EE
- 1st internship
- Milwaukee (Portland area)
- company:
  - focus on aerospace, defense, energy products
  - produced parts for Apollo Moon landing
  - New product development, sustaining engineering
    - NLI PCB testing
      - converts DC to AC
      - testing boards that were going into units
      - catch any errors in the board before assembly
      - used standard lab equipment
      - founds multiple issues (supplier side) which saved OECO paperwork, time, and money
    - DGCU Rework
      - goal: verify new voltage regulator circuit to handle more ripple
      - tested new schematic
      - created instructions on how to modify board
      - troubleshoot new design
      - created test plan, ran tests, and documented results of generator & induced ripple
      - Results: new design exceeded expectations and moved forward with confidence
    - RAT GCU Root Cause Analysis and Redesign
      - generator control unit and backup generator for aircraft
      - goal: find out why signals were behaving different and what could be changed to fix the issue and meet new spec
      - compare BOM of each version and looked for part differences in the circuits relating o the signal
      - Ltspice modeled each version and simulated them
      - tested how component tolerances could affect results
      - result: let customer know why GCUs were behaving differently (left before whole process was complete
      - Overall: worked with a lot of analog circuits
        - component tolerances
- military regulations
- documentation is very important
- Ltspice skills
- Altium (for laying out circuits and schematics)
- relatively small engineering staff (10-15 people)
- "high performance culture"
- military/aerospace terminology took some getting used to

**Datalogic**
- Quinn Handley
- CPE (computer engineering)
- 1st internship
- italian-based company
- 2-3K employees
- Eugene dept.
- company:
  - mobile scanners, barcode scanners, RFID, etc.
  - lots of R&D in Eugene
  - **Intro to Embedded ARM**
    - everything in the name of performance and speed
    - ARM neon SIMD coprocessor
    - testing & development on raspberry pi III
    - sliding window algorithm exercise- perform a set of operations on a data array. Set size of array
      - parallel operations are hard, but rewarding
  - **Code optimization for image processing library**
    - optimizing image processing algorithms (box filters)
      - used to find barcodes and reduce errors
      - needed to be very fast
    - integrating optimized code into linear bar code localizer application
    - unit testing (performance, correctness, memory access)
    - Version control with git and GitLab
  - learned:
    - very independent work situation; set own work flow.
    - all programming in C++
    - code optimization
    - effective communication
    - parallel programming
Brown and Caldwell
- Ryan Bay
- 1st internship
- EE
- environmental engineering
- 1700 people
- portland

projects:
  - Forest grove secondary clarifier
    - site plan
    - conduit/cable routing and sizing (underground routing)
      - must be oversized to avoid overheating
    - motor control schematics
    - VFD driven RAS pumps
    - Instrumentation to monitor and control RAS flow (FITs and LITs)
    - Loop Diagrams to describe instrumentation
    - overall: how to automate/power systems
  - oak lodge belt filter press retrofit
  - city of Vancouver industrial pre-treatment lagoon upgrade

learned:
- reading and designing electrical construction diagrams
- autoCAD

Cognex- Jessica Peterson
- first internship
- EE
- Machine vision for manufacturing facilities
- Portland, headquarters in Massachusetts
- Portland campus = 50; total employees = 2000

I/O breakout box
- provide inexpensive breakout for new cameras to prevent the use of flying lead cables in wiring
- provides landing points for the inputs and outputs
- small, compact, and mounting on din rails
- protect circuit from large impulses

Firmware verification
Input test box
LabVIEW test program
- verify power supplies (automate the procedure)
- visual-based programming
  - someone without programming background can understand it
Firmware Snippets and debugging
- checked register declarations

Cisco Systems- Alex Molisani
• first internship
• CPE
• Beaverton
• 20 people
• BMC group
  ◦ baseboard management controller- small chip on server that provides data about server health
  ◦ create interface to and software for the BMC
  ◦ C programming for the BMC and Python for build tree
• Unified event manager

• Consent tokens
• Python Oak configuration GUI
• Build Tree enhancements
• KVM development
  ◦ Keyboard video
• Increased knowledge of C, makefile, python
• working within a large code base and within a terminal
• writing more secure code

ATI - Richard Smith
• 1st internship
• EE
• department = 50; total plant = 1000-1500
• makes high-performance metals and alloys
  ◦ Zr fuel rods for nuclear reactors
  ◦ NbTi superconductor found in 90% of world's MRI machines
  ◦ Ti64 rod used in all SpaceX engine nozzles
• Zirc Spone Handling Upgrades (smaller)
  ◦ sponge refers to a 3/4" minus metal gravel
  ◦ create in crushers, alloyed in blenders
  ◦ crushers produce a by-produce called "fines" which are highly flammable
  ◦ "fines" are collected
  ◦ Level checked manually via small hole in top of barrel
  ◦ install level sensors and indicator lights
• Chlamine Station Controls Documentation and DeltaV Design (large)
  ◦ equipment that pumps liquid chlorine from rail cars, vaporized it, and sends it into the plant
  ◦ highly hazardous process
  ◦ designed UI for new touchscreens which replaced outdated buttons
  ◦ visual programming in DeltaV control studio
  ◦ wrote 33 page manual documenting UI
• Takeaways:
  ◦ projects in large companies take longer
  ◦ communication is super important
  ◦ pay attention to details
    ▪ NEC (NFPA 70)- national electrical code

Biamp Systems (AV company)
• Zack Steinberg
• EE
• Beaverton
• started in music industry, moved towards commercial applications
• 200-300 people in office, engineering was about 75
• Current sensing research/implementation
  ○ researched different methods of current sensing
  ○ considered alternative components for replacement of methods currently used in Biamp products
  ○ met with suppliers and vendors to discuss pros/cons of different sensors
  ○ retrofitted existing products with new sensors and tested accuracy and THD+N of different methods
  ○ documented results with schematic changes for alternate components
  ○ useful for cost saving on products in development
• RJ45 to 4 pin Phoenix adapter
  ○ small adapter board for internal testing
  ○ provided stable alternative to handmade cables
  ○ also served as good introduction to using altium designer for schematic and PCB layout design, and releasing CAD files for fabrication and assembly.
• Switching resistive load
  ○ used for amplifier testing
  ○ high wattage resistors connected with relays for configurable channels
  ○ user controls resistor configurations per channel by button input
• Pink noise generator
  ○ internal testing
  ○ used as alternative to digital noise generator in product testing
  ○ different configuration options, modified gain and output stages for given schematic
  ○ pink noise is linear; white noise is flat.
• Departments:
  ○ hardware engineering- design tips, schematic and layout help, ordering parts/PCBs for projects, mechanical help
  ○ DSP team- advice on current sensing testing with accuracies needed, thing to look for in sensors

Daimler
• Thomas Prihoda
• first internship
• CPE
• advanced engineering department
• 3-4K people
• Portland, Oregon
• Hybrid system of daimler's supertruck II project
  ○ worked with ECUs
  ○ fair amount of cabling work
  ○ almost exclusively in or under a truck
  ○ Programming AC system for superTruck
    ▪ controls for compressor RPM to manage evaporator temperature
    ▪ controls for 48V condenser fans to manage high-side pressure
    ▪ porting legacy targets to new system
• tuning PID controllers to maximize response

Challenges:
• many variables impact charging voltage
• Simple PID was too slow to respond to RPM changes
• Created new PID control system

Genentech- cancer medications
• Hillsboro: 300 people
• Justin Tran
• EE
• 1st internship
• packaging line camera job
  ○ problem: old camera job was unintuitive to use, missing features, and was falsely ejecting product when it was placed in a certain position
  ○ solution:
    ▪ new tool used to detect vial not affect by the issue the old job had
    ▪ implemented flip cap detention
    ▪ created new camera job from scratch
      • semi-automated tuning
      • more data stored for future tuning
• automation lab test camera setup
  ○ problem: current documentation system for the automation team was not meant to be used for that purpose. Because of this, there are many extra steps that take up a lot of time.
  ○ solution:
    ▪ communication with different departments
      • working with IT to find a system for our situation
• documentation system change
  ○ problem: lab test camera could only be triggered from a laptop and did not properly activate the lights
  ○ solution:
    ▪ wrote PLC/HMI program to control camera
      • 4 different output to the camera
      • can set to continuously trigger
      • can alter trigger frequency and duration

Layard- Planar systems
• Lyubo Gankov
• First internships
• ECE
• small, quiet office
• Upgraded IR test fixture
  ○ Made sensor PCBs (either have phototransistor or IR LED)
    ▪ make breakout board PCB (connects to sensors /controller)
    ▪ Used autodesk eagle
  ○ All parts used are off-the-shelf for ease of repair
• Magnetic Polarity sensor prototype
  ○ Validates whether magnets are installed correctly (1N, 1S facing up)
  ○ Using hall effect sensors + microcontroller (programmed in C)
• Breakout PCB design & power meter assembly
- Designed a PCB for DC box- built 6
  - converts from connector to screw terminal
  - measures how much power is used from a wall outlet
  - contains relays to cycle power to output
- AC box- built 2
- Power meter calibration fixture
  - found an electronic load with AC/DC functionality
  - used as a comparison for power box measurements
    - E-load draws known amount of power
- Reflection/takeaways:
  - Calibration procedures and requirements
  - Designing for manufacturability, usability, design experience
  - Organization, prioritization of work
  - Importance of communication and documentation

**Fortis construction (at Facebook datacenter)**
- 1st internship
- Leonora Huynh-Watkins
- near Bend
- 500 employees
- Day to day responsibilities:
  - submittals
  - RFIs
    - requests for information
  - meetings
  - BIM issue resolution
- Weekly responsibilities
  - OAEC Reports
  - Executive summaries
  - Subcontractor RFI Audit
- Longer Term project:
  - Fire Alarm Commissioning
  - Generator Coordination
    - Bonding
    - Housing
  - Short circuit coordination study
- Takeaways:
  - what a "real job" is like
    - being part of a team
    - general contractor function
    - how to run a meeting
    - management/leadership skills

**Keysight**
- Brogan Miner
  - EE
- First internship
- Beaverton
- 50 people at the office
• QA for Wi-Fi testing devices
• Lab equipment layout and installation
• Internal tools development

Garmin
• Matt Guo
  o EE
• Salem
• LED test controller
  o Mass production of upcoming product to occur very soon, need a way to test the LED backlight.
  o Currently, production tests the LED backlight after the whole unit is assembled
  o test controller mimics PWM drive signals from a board in the unit to test the LEDs before installation
  o Needed to protect microcontroller from power surges
• Power sequencing:
  o LCD on an upcoming product requires very specific voltage timing requirements to ensure longevity of the display
  o voltage rails must be powered on after Vcc to protect the LCD from DC voltage
• Proximity sensor PoC
  o proximity sensor for tracking small objects inside airplane cockpit
  o varying sensing circumstances: altitude, temp, etc
  o sensor must not emit IR
  o ultrasonic tech used to measure time of flight
• Takeaways:
  o schematic design:
    ▪ electrical isolation
    ▪ PWM drive
    ▪ digital logic
    ▪ power sequencing
  o PCB layout
    ▪ DC-DC converters
    ▪ critical component placements
    ▪ routine techniques
    ▪ minimizing current loops
    ▪ ideal vs. real components

Daimler
• Jai Yi Li
  o EE/CS
• Swan Island, Portland
  o near University of Portland
• Traffic sign recognition:
  o optical character recognition
    ▪ Goal: utilizing machine learning object detection to detect speed signs and optical character recognition to autonomously read and understand speed signs.
    ▪ Object detection algorithms: YOLO and semantic segmentation
    ▪ Image processing:
• brightening
  • normalizing
  • resizing
  ○ Convolution neural networks
    ▪ first half is same as optical character recognition

• DTC/signals popup datamining
  ○ develop a custom script to query signals from database to determine the amount and types of popups that are shown to truck driver over a period of time

• Testing Workshop in Madras, OR
  ○ feature testing with feature owners

• Department Hackathon
  ○ develop custom script for datamining and data visualization on internal website

• Takeaways:
  ○ don’t be afraid to ask
  ○ communication is key
  ○ enjoy your internship and build connections

Triaxis (David Evans)
• Ryan McCullough
  ○ 2nd internship
  ○ energy business unit intern

• Corvallis and Portland

• Services:
  ○ energy
    ▪ substation design
    ▪ transmission design
  ○ water and environment
  ○ surveying and geomatics
  ○ transportation
    ▪ bridge and structures
    ▪ roads and highways
    ▪ transit and railroad
    ▪ construction engineering
  ○ marine services

• Canby Utility Systems case study
  ○ simulating canby’s grid in easyPower software
  ○ Coordinating time current curves
  ○ short circuit analysis
    ▪ EasyPower software can quickly simulate single line-to-ground faults, line-to-line faults, double line-to-ground faults, and three-phase faults
  ○ contingency analysis
  ○ correlations between weather and peak load
    ▪ higher demand in winter because of heating
  ○ demand forecasting

• Learned:
  ○ power flow simulations
  ○ fault simulations
  ○ coordinating relays with fuses and damage curves
- communication
- organization
  - multiple tasks at once

**Tektronix**
- Huy Nguyen
  - second internship
- Portland
- 5000 people on campus
- Jitter Project
  - Design a jitter modulation module that is compact and affordable. It also will be easier to use and reduces overall testing time in comparison to current methods
  - jitter is timing errors which occur in data transfer due to various sources of noise.
  - Current setup was complicated, expensive, slow, and bulky
  - Solution was compact, affordable, faster and full automation capability
    - few thousand dollars instead of quarter million
- Lessons:
  - deeper understanding on how instruments work
  - gaining knowledge about high-speed RF signal and apply to circuit/PCB design
  - Programing language: Matlab and Python
  - Industrial design tools: Allegro Cadence
    - used to design circuit boards
  - Teamwork
    - project assigned to a team of interns, not traditional (one-on-one) mentor model

**Eaton:**
- Benjamin Kawasaki
  - second internship
- Tualatin (~100 people)
- Power focus area (course load and work at Eaton)
- buck converter (steps voltage down)
  - steps current up while voltage is stepped down
  - upgraded 10A design to 30A design
- 10A buck converter (testing)
  - also converts 24V to 12V
  - conducted testing on prototype board
  - troubleshooting
- Takeaways:
  - presenting designs for review
  - best practices for power conversion components, control schemes, and protection
  - balancing design choices based on functional trade-offs, safety, space, and cost
  - Altium designer:
    - schematic/PCB editor with 3D modeling capability
    - commonly used in industry

**Intel**
- Matt Boe
  - second internship
• CE
• 1000 people on campus (or more)
• SFP and QSFP Interceptor
  • finished design of SFP interceptor and designed QSFP
  • SFP and QSFP:
    ▪ hot pluggable network modules
    ▪ from 1GB/s to 200 Gb/s with QSFP
    ▪ small form-factor pluggable transceiver + quad SPF
    ▪ SFF-8472
  • Board designed to intercept sideband signals and module EEPROM
    ▪ intercepts and modifies I2C and other low speed signals between host and module
    ▪ can make the system think another module has been presented or that the module
      has changed state, testing how hosts handle presented information
    ▪ allows for test automation in a physical environment
  • Completing SFP Interceptor
    ▪ update GUI
    ▪ Update bootloader HW
    ▪ Firmware bugs
  • Generating QSFP Interceptor
    ▪ Port SFP Interceptor
    ▪ Incorporate what was learned from SFP
    ▪ Design schematic and update FW and GUI
• Power sequencer evaluation
  • evaluated device to sequence power on and off and test
• OCP NIC 3.0
  • Open Compute Project Network Interface Card
  • Created functional block diagram as a reference for future designers
  • Open compute project
    ▪ several member companies including Intel
    ▪ Started by Facebook to create a standard for network cards
  • Network Interface Card 2.0
    ▪ Large and small form factors
• Learned:
  • designing a GUI with Qt for Python
  • I2C protocols and timing
  • Cadence design tools
  • Document what you are doing and what you have completed
  • Communicate regularly with mentor, manager, other interested parties
  • reach out to others. Look for new things to do, new things to learn, new people to meet.

Schneider Electric
• Roberto Bech
  • EE
  • second internship
• Energy management/efficiency
• Worked in Tualatin
  • 200 employees on-site
• Flash file transfer
C# terminal interface
  - Simple interface
  - Port selection prompt
  - Ability to use on most projects

Serial flash memory chip
- UART
- File Transfer
- Document firmware commands, and function workflow

RTOS:
- Validation and verification requires known values
- Suspend updates
  - Force known values
- BACnet Sensor updates
  - Does not interrupt RTOS routines and tasks
  - Provides realistic operation
  - Validation engineer reads values through terminal, BACnet, and also the unit display.

EcoStruxure Building operation
- Workstation connects to controllers that connect to room units
- Display readings, alarms (issues), graphs
- Room units reads:
  - CO2, occupancy, temp, humidity

Driver Development
- CO2 driver, room humidity, and temp
- Portability: program in layers
- Application:
  - Display sensor readings
  - RTOS calls read sensor

Cyber Security:
- Secure coding practices
  - Never use unsafe functions
  - Ex: atoi doesn't handle unterminated strings safely, use sscanf instead.
- Input validation
- Whitelist validation
  - Allows known good input and rejects everything else

Portland General Electric
- Zack Bendt
  - First internship
- Tualatin office
  - About 200 in office; 3,000 in company
- West Side Hydro Controls Upgrade
  - Made up of many smaller projects
  - Project was owned by another department
  - Required coordination with many other departments
  - Designed upgrades to communications equipment
    - Rack elevations
    - Cable tray layouts
    - Chassis wiring diagrams
• AcrFM- Fiber Manager
  ○ New software Telecom is using to document fiber optic cable
  ○ Entered fiber routes into GIS database and submitted to GIS department for posting
  ○ Held weekly meetings to develop standards and review processes for entering information into the database
  ○ Created documentation for process for entering conduit systems

• Several Small Projects
  ○ Faraday New Warehouse/Machine Shop corporate LAN

• Departments I interacted with:
  ○ Materials coordination
  ○ communication technicians
  ○ storeroom
  ○ geographical information systems (GIS)
  ○ physical security
  ○ drafting/engineering contractor

• Learned:
  ○ fiber optics
  ○ MPLS
  ○ SONET/TDM
  ○ AcrMap GIS software
  ○ Microwave and Radio
  ○ Power Generation

Cognex
• Colin Bond
  ○ 2nd internship
  ○ CPE
• 300 people in company
• Portland office of about 75 people
• License Validation
  ○ confirm all needed licenses are present
  ○ parse JSON string for license information
  ○ Compare what is present with desired
  ○ Confirms unit is configured correctly
• Synthetic image verification bugfix
  ○ bad pixel correction would corrupt synthetic image
    ▪ determine which pixel is wrong
    ▪ average surrounding pixels
• File Synchronization
  ○ loss of data after reboot
  ○ flush buffers
• Image Acquisition Stress test
  ○ test individual parameters
  ○ test the test
  ○ stress test runs overnight
    ▪ attempt running multiple threads
• Reboot functionality
• encrypting files
• hostname fix
• disable ports and services
• Learned:
  o source control - Git
  o Working with large code repositories
  o communication skills
  o scrum
  o PyBinds
    ▪ Python code to talk to C++ code
  o Refined coding skills

Concept Systems
• Art Yakimov
  o EE
  o 2nd internship
• Automate things (manufacturing automation, packaging, etc.)
• very small company (about 100 people)
• Albany office
• Projects:
  o PLC Programming
    ▪ Ladder logic
      • Use ladder logic per customer’s request.
      • Allows technicians to troubleshoot
    ▪ Use ladder logic to control robots, devices, and sensors to automate a process
  o HMI programming
  o Testing panels and I/O devices in house
  o Customer site integration
  o Project Management
  o Creating and updating project documentation
• Example system structure:
  o Operation interface (HMI)
  o Logic (PLC)
  o Drives (Control VDFs, Servo Motors, etc)
  o Safety (Relays, circuit breakers, E-stop)
  o Sensors & switches (Photoeye, limit switches)
  o Connectivity
  o Power supply