BACKGROUND

• Christopher Lai – Project Engineer, Mechanical and Aerospace Systems
  – MS Mechanical Engineering and Product Design from the University of Colorado at Boulder

• Focused on Consumer products and Aerospace design

• 5+ years at Quartus
BACKGROUND: MILITARY SERVICE TO ENGINEERING DEGREE

- Tim Christianson – Project Engineer, Optical systems
  - BS Mechanical Engineering from the University of California San Diego
- Enlisted in the Marine Corps out of High School
  - ASVAB
    - Armed Services Vocational Aptitude Battery
    - Determines skill levels in math, language and problem solving
  - MOS Selection
    - Military Occupational Specialty
  - Benefits and Signing Bonuses
    - Marine Corps College fund

- Training and Schooling
  - Air Traffic Control Equipment Technician
  - Job skills
- College Education
  - Montgomery GI Bill
  - State/Federal Grants
- College Experience
  - Financial freedom
  - Low stress
  - No college debt
- Scripps Oceanography, Whale Acoustics Lab
- Quartus Engineering
STEM Skills

- English
- Math and Physics
- Computer Programming
  - Data analysis
  - Automated Data Collection
  - Deliverable Programs
  - Matlab
    - GNU Octave is a free version
- Learning how to learn
  - Tasks never done before
    - Feasibility
    - Determine path
    - Work through problems that arise
  - Ex: Assign math or physics assignment in Matlab or Octave without teaching coding or how to run the software
ABOUT QUARTUS
Quartus Engineering

Mission Statement
We create extraordinary value for our clients by partnering with them and providing solutions that exceed expectations while creating opportunities for our staff to grow intellectually and professionally.

- Industry leading knowledge of Computer Aided Design and Analysis tools
- Established company with over 20 years of engineering excellence
  - Founded in 1997
  - 100+ Degreed Engineers on Staff, Variety of Disciplines
    - 115+ employees company wide
  - Two Locations in US: San Diego and Washington DC
QUARTUS HISTORICAL OVERVIEW

1997
- Quartus Founded
  - 4 Engineers from SDRC
  - 3 founders remain

2002
- 5 Year Growth
  - 20 Employees
  - Full-time VP Sales

2007
- First Product
  - Delivered first manufactured product, 12 Units

2009
- Virginia Office
  - Opened additional Analysis office in Metro DC area

2009
- Clean Room #1
  - First cleanroom built in San Diego HQ facility

2011
- ISO-Certification
  - Quartus Manufacturing received ISO-9001 Certification

2013
- MFG Facility
  - Expanded San Diego MFG operations with additional facility including new 1000SF clean room

2014
- HQ Expansion
  - New San Diego Facility
  - IRAD investment in customer production automation
  - 100 employees

2015
- Low Rate Production
  - Second manufacturing facility
  - Low rate production of 100 units
  - Dedicated Staff for Manufacturing capability growth

2016
- QUARTUS ENGINEERING
QUARTUS FACILITIES

• Recently relocated to new facility in San Diego
  – Combined 3 previous San Diego facilities
  – 47,000 s.f. facility
  – 18,000 s.f. manufacturing space
    • Primary products are electro-optical and electro-mechanical related
  – 6,000 s.f. of Class 10,000 clean room space
    • Primary products are optics related.
  – Collaborative work spaces
  – Electrical and Software development spaces and labs
  – In-house machine and fabrication shop

• Washington DC office
  – Local support for eastern region clients
Quartus Capabilities

System Design & Development
- Advanced Structures
- Optical Systems
- Aerospace Products
- Electronics & Controls
- Automation

Simulation & Analysis
- Structural Analysis
- Structural Dynamics
- Thermal Analysis
- CFD & Flutter
- Coupled Loads Analysis
- Aerelastic Analysis
- Composites

Testing
- Environmental Testing
- Reliability Testing
- Optical Metrology
- Model Correlation
- Modal Survey Testing
- Data Acquisition

Manufacturing
- Prototype
- Low Volume Production
- Cleanroom Assembly
- Spaceflight Hardware
2015 REVENUE BY INDUSTRY

- Aeronautics: 35%
- Spacecraft: 13%
- Photonics: 23%
- Consumer Products: 4%
- Entertainment: 2%
- BioMedical/Life Sciences: 8%
- Industrial: 15%

Total revenue is 100%.
PROJECT EXAMPLES
HARRIS AIRBORNE LIDAR SYSTEMS

- Quartus responsible for sensor hardware system development, manufacturing, qualification testing, platform integration, and flight testing support
  - Harris IntelliEarth Geospatial Solutions ITI-1000 active 3D imaging systems
  - Images courtesy of Harris Corporation
- Development plan included brassboard design, build, and test by Quartus to validate system performance predictions
- Design for manufacturing and assembly and Quartus equipment allowed for efficient build/test cycle
  - First system designed, built and delivered to customer ahead of schedule, under a year
- 3 units delivered and currently in service

Brassboard LIDAR System w/Gen 1 scanner: Refractive
Flight LIDAR System w/ diffraction grating scanner

Qualcomm Stadium, initial images
20 pts/m² Geiger LiDAR overpass with no intensity
ELECTRO-MECHANICAL PRODUCTION LABELING SYSTEM

- **Problem?**
  - Different kinds of fruits on the same production line need to be labeled

- **What’s needed to solve the problem?**
  - Print on demand labels

- **Brainstorming results**
  - Thermal print heads

- **Requirements:**
  - Ability to be retrofitted to current warehouse equipment
  - Design and build in < 1 year
  - Easy operation for users

https://youtu.be/j5mfRwZUOss
Quartus provided turn key automation systems in low rate production quantities
- Design, analysis, test and integration
- 3 design and build iterations in less than 9 months

Custom developed control algorithms for thermal print heads and tape tensioning system including feed rate, timing and dispensing methods
- Worked closely with the customer team to meet all requirements
- Exceeded throughput of off the shelf system

Electronic PCB design layout with FPGA
- Program algorithm, motion control, timing and sequencing

Seamless integration of prototype into production environment in 4 days with no downtime

Graphical User Interface for integration to existing system
- Machine operator interface
- Password protected technician interface

Quick interchange for “reloading” to minimize downtime

Utilized batch build assembly to optimize delivery schedule and allow for rapid design change integration

On-site installation and support

Deliveries
- Phase 1 – 2 Units (3 weeks)
- Phase 2 – 12 Units (6 weeks)
- Phase 3 – 98 Units (8 weeks)
SUMMARY

Quartus has the expertise and capacity to help achieve your goals. We welcome the opportunity to explore how we can work together.

Questions????

www.quartus.com