ORAL ROBERTS UNIVERSITY ENGINEERING GRADUATES OF 2015

Eight engineering students graduated with B.S.E. degrees and one student with a B.S. degree.

Back Row: Dr. Leland, Dr. Zhang, Dr. Ma, Dr. Gregg
3rd Row: Dr. Liu, Daniel Dickie, Dr. Matsson, Greg Butron, Professor Akbar
2nd Row: George Toby, Thomas Adams, Charles Tines, Leif Peterson
Front Row: Mila Mathew, Daniel Rykert, Michelle Ng

# 2014 – 2015 SENIOR DESIGN PROJECTS

DETERMINATION OF THE MECHANICAL PROPERTIES OF A LAMINATED COMPOSITE BEAM FOR APPLICATIONS IN LONGBOARDING

Daniel Dickie and Charles Tines

In this project the Young's Modulus and Modulus of Rupture for Baltic birch plywood of multiple plies was determined. These moduli allow predictive analysis to be performed on the behavior of laminated Baltic birch sheets under various loads. Baltic birch, a specialty wood sourced from Russia, is used in the longboarding industry as a base material for decks, the foundation of a longboarding assembly. Longboarding is a quickly growing recreational and professional sport that is on track to surpass snowboarding, surfing, and most importantly skateboarding as the most popular board sport. Research has shown that many small and large scale deck manufacturers use Baltic birch but have and continue to do so in a provisional manner, neglecting to understand the relationships between thickness, flexibility, and grain orientation. The results of this project allow the predictable and repeatable manufacturing of these decks based on a technical understanding of the properties of this composite material.
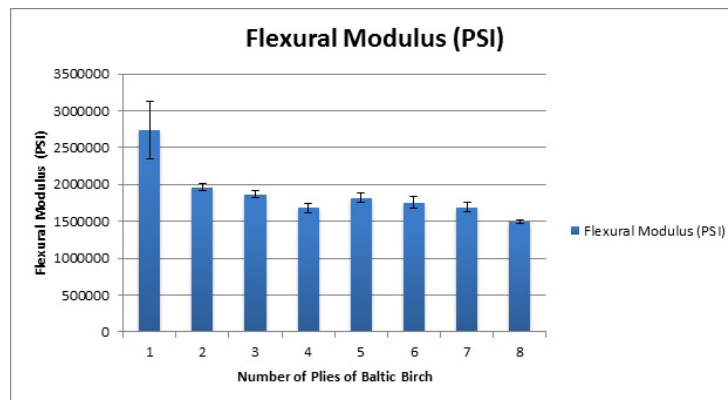

Summary of flexural modulus for different number of Baltic Birch plies

WIRELESS CO-EXISTENCE IN MEDICAL CENTERS
Gregory Butron and Leif Peterson

The purpose of the project is to create software that helps with the analysis of wireless environments (especially medical environments) and determine if the wireless channels in the environment have enough free space for more devices to be introduced. In order to do this we wrote software to process wireless spectrum data collected at two hospitals. We delivered the software and processed data to a team at OU who is standardizing wireless co-existence testing for the FDA.
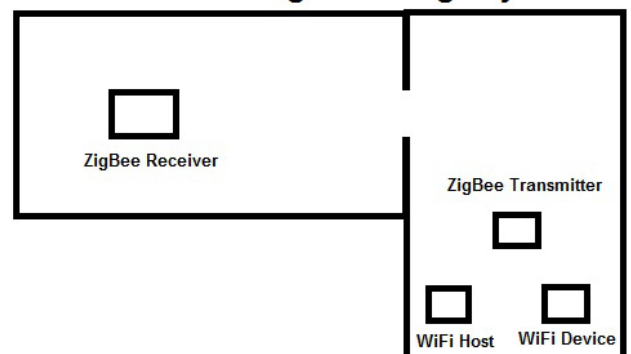
DESIGNING A SOLAR COOKER FOR MALAWI
Michelle Ng and Tom Adams

The purpose of this project is to design an inexpensive yet effective solar cooker that can be manufactured and sold in Malawi. The cooker will help to reduce the amount of wood and charcoal being used to cook meals and purify water in Malawi, decrease health risks of frequently inhaling charcoal smoke, save the Malawians money, and also provide jobs as local workers can manufacture it to be sold. The solar cooker is being designed with the guidance of Randal

Perisho, who conceived the project, and Dr. Robert Leland, the groups' advisor. It must be able to be built for less than $30, withstand 15 mph of wind, and reach acceptable cooking temperatures. The final design can be built for just under $30 and easily withstands wind. It brought 2 q. of water to 180°F in less than 45 minutes and boiled it in about an hour.

AUTOMATED GRAM STAINING SYSTEM
Mila Mathew, Daniel Rykert and George Toby

An automated gram staining apparatus is designed and manufactured for the Biology Department of Oral Roberts University. The process of gram staining helps students and medical professionals distinguish between two main types of bacteria by staining the sample with various dyes.

The apparatus consists of a conveyor belt that will move the slide containing the bacteria through a four-stage chemical application process. Four dyes are used to stain the bacteria at different stages for a specified amount of time. Automating this process will improve the accuracy and

consistency of the samples. The scope of the project is to automate this process with minimal assistance or involvement of the student. The targeted beneficiaries will be students studying various fields of medicine and the biological sciences.

MANUFACTURING ENGINEER INTERNSHIP WITH TRIUMPH AEROSTRUCTURES
Alec Mackie

Triumph Group Inc. – Tulsa is an Aerostructure Engineering company that is in charge of designing and building the wing assemblies for the Gulfstream G650 and G280 corporate jets. My internship was in the manufacturing department, and I also completed a few projects in the design field. My main job was to standardize the build-process for the Butt Line Zero portion of the wing assembly. Butt Line Zero is the rib at the center of the two wings when they are joined. This process contained a lot of variation in the way that different mechanics performed the drill-out operations, resulting in a high volume of quality notification "tags." After

spending a large amount of time on the warehouse floor observing the mechanics, taking pictures of their work, and discussing operations, I created a 40-page document detailing the specific process for completing this portion of the wing assembly. This document optimizes the process by detailing procedures that result in the most successful build and created a standard that will be used to train future mechanics.

I also was included in the team of engineers tasked with eliminating the shims currently being used to ensure a perfect fit for key parts of the build. During the build-process, if two of the parts did not fit perfectly "flush"

against one another, the mechanics were required to fabricate shims that would be bonded to the parts to fill these gaps. During my Butt Line Zero build project, I noticed that a specific part of the assembly required the mechanics to spend 5-6 hours on every unit shaving down about .080" thickness on a metal sheet for a shim. I recommended ordering this shim as a pre-fabricated part to save time until a more permanent solution was found for the shim elimination. This idea caught on, and I designed the part in their computer animated design program, CATIA, created a drawing of the model, and sent it off for an analysis of the cost to order the

pre-fabricated part versus the cost of the time for the mechanics to manually fabricate the shims. It turned out the part would save the company money, and they are in the process of ordering this shim design for every wing unit.

This internship was valuable because it enabled me to see the difference between the outlined manufacturing processes created using CAD software by the engineers upstairs and the actual build-process performed by the mechanics on the warehouse floor.

ORU ENGINEERING MAJOR BRANDON BRAUN INTERNED AT SANDIA NATIONAL LAB

This summer I've had the opportunity to become intimately acquainted with electrical modeling techniques for various power regulation ICs using Cadence's OrCad software including Capture, PSpice, the Model Editor. I've been tasked to model both linear and switching regulators using datasheet information exclusively. I'm also tasked with creating models that bound the device performance based on variations in manufacturing. In addition, it was imperative to capture temperature effects on the devices over a wide temperature range. This work has been a pioneering effort within my department at Sandia and had a strong positive impact on this year's goals. One noteworthy accomplishment was that I implemented a modeling technique for a switching regulator called state-space (averaged) modeling, which greatly improved simulation times in the system level circuit model. The average model required abstraction of the function of a switching regulator which is notoriously complex and my implementation successfully mapped the proper circuit behavior from the datasheet into the model. Even though the summer is done and I am back at school now, I am blessed to be able to continue on as a year round intern.

ENGINEERING FACULTY ACCOMPLISHMENTS

- Dr, Gregg attended a conference on Laboratory Instruction at the University of Maryland on July 22-24, 2015 (2 posters with honor students).

- Dr. Gregg acted as reviewer and member on the Physical Science Content Advisory Committee of Oklahoma Office of Educational Quality and Accountability (OEQA).

- Dr. Halsmer published the conference paper "How Dialogue on Ingenuity in Nature Increases Enthusiasm for Engineering" for the 2015 ASEE Annual Conference on June 14-17, 2015.

- Dr. Leland advised a senior project by Thomas Adams and Michelle Ng to develop a low-cost solar cooker for use in Malawi. This solar cooker would replace charcoal burning which currently causes many health problems.

- Dr. Leland received an OCAST Award for his collaboration with CRTS, Inc. This award is $34,360 over 2 years and provides a paid internship for an Engineering student.

- Dr. Liu attended the Oklahoma EPSCoR Women in Science Conference on October 14th 2014. She brought four engineering students and set up a hands-on science and recruitment booth to promote the ORU Engineering program at the conference.

- Dr. Liu met with Douglas Price, Global Education Dean at TCC discussing the possibility of Global STEM project

- Dr. Ma acted on the Editorial Board of the International Journal of Vehicular Technology, Hindawi Publish House.

- Dr. Ma presented a paper at the IEEE International Conference on Computing, Networking and Communications (ICNC'15) on Feb. 19, 2015.

- Dr. Ma visited Tongji University, Shanghai, China on May 8, and gave an invited talk in the seminar titled "On QoS of Vehicular Ad Hoc Networks for Safety Related Services".

- Dr. Ma visited the China University of Petroleum, Qingdao, China on May 19, and gave an invited talk in the seminar titled "Research on Vehicle-to-vehicle Communication for Safety Applications: Current Status and Future Perspectives".

- Dr. Ma published the following papers:

  (1) "Performance analysis of secure beaconing messages for GeoNetworking",
      J. Lee, T. Ernst, and Xiaomin. Ma, Security and Communication Networks 7(12): 2555-2563, Dec. 2014.

  (2) "Performance and Reliability Evaluation of BSM Broadcasting in DSRC with Multi-Channel Schemes", X. Yin, X. Ma, K. S. Trivedi, and A. V. Vinel
      IEEE Transactions on Computers 63(12): 3101-3113, Dec. 2014