Thank you, Poly-Wood!

Five awesome picnic tables were donated by our Indiana member, Poly-Wood, Inc. These tables are located around the Parkview cafeteria and all engineering students are already enjoying them. 😊

LED Lighting Assembly Ergonomics Study @Landscape Forms, Inc.

Written by Lorena Peña

As an outdoor furniture manufacturer, Landscape Forms (LF) offers customers a variety of lighting products with classic, contemporary, and transitional styles. Due to product requirements and workstation design the assembly of these products requires a combination of
high force exertion (31 lbs.), motion repetition (16 to 32 times) and an uncomfortable posture (see figure below). Therefore, the process impact on the workers’ health as well as its economic implications were analyzed, quantified and improved during this ergonomics study.

The approach taken for this ergonomics study was to interview workers, measure workers’ risk and exposure, and quantify potential damages. The workstation was analyzed in terms of work area, tools and materials used, and their dimensions and arrangements. A Discomfort Body Map Assessment was completed to identify changes in pain or discomfort in different parts of the body before and after assemblies. In addition, the Rapid Upper Limb Assessment (RULA) and Rapid Entire Body Assessment (REBA) scores were calculated.

The workstation design analysis showed that the work surface height was not appropriate for fitting the operators. This also helped concluding that the lack of a holding fixture for the LED domes was affecting the worker’s position. According to the operator discomfort assessment, there was a 20% to 30% increase in discomfort in their upper body after finishing the assembly. Looking at the RULA and REBA scores, 7 and 11 respectively, the team was able to conclude that there were high risks for the operators to develop musculoskeletal disorders and that immediate changes were needed. Considering the upper body MSDs and their average annual cost of $10,753, the following recommendations were made:

1. Workstation redesign for seating and standing posture,
2. Add a holding fixture for dome placement,
3. Use power grip hand tools for horizontal work,
4. Purchase a mechanic arm able to exert the required force
5. Economic Analysis (with one operator at $23 per hour):
   - Purchase cost: $24,500.00
   - Estimated annual benefits: $51,621.00
   - Estimated net benefits after one year: $27,121.00
   - Payback: 0.47 years (5.6 months)
   - Effectiveness of the solution: A mechanic arm would eliminate the need for gripping with high force as well as the awkward posture of the wrist.
   - Productivity improvements: Standardizes (ideally reduces) the assembly time.

Following the study’s recommendations, LF proceeded to purchase the mechanic arm depicted in the figure above to improve the process. The details of this study and other follow ups were discussed at our semi-annual meeting past October 1st.

**International Congress of Sustainability, Science and Engineering (ICOSSE)**

*Written by Marylin Glass*

This past August, Marylin N. Glass-Angeles, participated at the ICOSEE as a technical, plenary speaker and poster presenter. Marylin is a Graduate Research Assistant and Project Manager at the GMIC, and a PhD Candidate in the Industrial Engineering and Engineering Management programs at WMU. The purpose of the conference was to exchange emerging ideas on means of protecting the environment and achieve sustainability, benefitting future generations; and the focus, to manage natural resources and industrial sustainability utilizing engineering and scientific innovations.

The program was divided in three grand sessions: Water Sustainability & Innovative Technology, Sustainable Manufacturing and Sustainable Energy. Marylin’s presentation was included under the Sustainable Manufacturing session. Both her presentation and poster covered the GMIC’s approach to zero-waste-to-landfill, via landfill audits and dumpster dives. Along with other undergraduate and graduate students, Marylin has participated and managed several ZWTL projects for the GMIC and its member companies. The
presentation outlined procedures, best practices and results that build the road map for organizations to become zero-landfill. Furthermore, the research illustrated complete landfill assessments and initiative plans for companies that have begun their quest to zero-waste. Marylin received kudos from the session chair and audience, and other researchers engaged her after her presentation to learn more about the subject, including an Environmental Protection Agency (EPA) post-doctoral fellow.

To learn more about this congress, visit: www.icosse.org.

Senior Design Project: Paper from Organic Banana Tree Waste

Written by Lorena Peña

Team members: Fainelys Encarnacion, Denis Mursoi, Austin Sievers, and Lorena Peña (GMIC).

Academic Advisors, Industrial/Manufacturing Engineering Department @WMU: Dr. Azim Houshyar and Dr. Bob White.

Industrial Advisor: Gustavo Gandini (Banelino’s Project Coordinator).

The Dominican Republic is one of the largest exporters of organic banana in the world (6,973.9 tons per week). The main market for organic banana is Europe, primarily England, France, Germany and Netherlands. The majority of the fruit is labeled as a Fair Trade product, which is a social movement dedicated to help producers in developing countries to provide optimum trading conditions and promote sustainability. Banelino, a non-profit banana producers’ cluster in the DR, is committed to the environment as well as to the social and scientific development in the poorest Dominican provinces, Montecristi and Valverde.

The purpose of this senior design project is to present Banelino a business plan and facility design for sustainably manufacture paper out of the current banana tree waste in plantations. This would add value to the industry, create jobs, and enhance business’s sustainability north of the DR.

Farewell, Nate!

Written by Nate Bowen

In August, former GMIC student researcher Nate Bowen started a new internship at TH Plastics in Mendon, MI. As an injection molding manufacturer, TH supplies Whirlpool Cooperation with many parts for household appliances. It is a very exciting time to join this team, as TH is currently outgrowing its facilities and expanding production greatly.

His role as a product engineering intern is giving him the opportunity to learn and review injection mold design. Through this process Nate has been learning Creo Pro/ENGINEER CAD software for solid modeling and analysis.

In addition to molding, Mr. Bowen has been getting exposed to fixture automation through a number of visits to TH subcontractors in the west Michigan area. This has been very exciting because of his interest in the robotic integration of the manufacturing process.

Nate is assisting in developing a relational database for mold and part designs and information, as well as material specifications. This will enable TH Plastics to better manage its assets as it continues to grow and acquire more tooling and machinery.
Nate Bowen is excited for what is ahead of him at TH Plastics and knows that he will learn a great deal more as he sharpens his engineering toolset in real world application.

**Best of luck, Zac!**

*Written by Zac Miller*

Since August 2011, Zac Miller has also been working as a college co-op at American Axle & Manufacturing in Three Rivers while studying civil engineering at WMU. AAM is a global company that makes axles and drive train components for GM and Chrysler vehicles, with plants everywhere from Michigan to Mexico to Thailand. As far as he knows, Zac is the only civil engineering student working for AAM; most of the co-ops and engineers are in manufacturing, mechanical, or industrial engineering. Fortunately that hasn't stopped him from getting some great work experience. For the past two years, most of his projects were focused on lean manufacturing and productivity. This opened up the opportunity for him to work with the GMI team over the past year and apply what he learned at work in other manufacturing settings. This summer he transferred to the facilities department at AAM, and he has been assigned to several major projects that deal with energy and cost savings.

His first project was aimed at replacing the plant’s outdated fleet of 90 forklifts with newer A/C drive forklifts that use less energy. He spent countless hours this summer wading through data about runtime, lifting capacities, amp draw, and financial cost for each individual forklift in order to come up with a cost analysis and a 10-year plan. With that project in the final stages of financial approval, his next assignment is to optimize the air-handling system for the entire plant. The Three Rivers plant is about 900,000 square feet and the inside air is heated and cooled by 20 semi-trailer-sized units on the roof. The units use a closed loop of water to transfer heat to and from the air. The units are over 30 years old but they have been updated with a central controls system that can be operated from a single computer. Because of the age of the units, there are problems with some sensors and gauges feeding the system false signals that in turn cause the units not to operate efficiently. Zac will be working with a team of electricians and mechanics to repair and update everything, then he will revisit the way the entire system operates and look at ways to reduce energy usage while still keeping the inside air temperature constant. With the changes at work, Zac will be leaving the GMI team for the 2013-2014 year, but he does so regrettably and wishes us all the best.