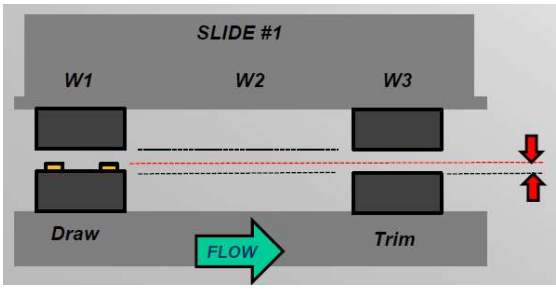
SECS Senior Design
Available Projects – Fall 2022

Ford – Cushion Pin Project

Sponsors - Conrad, Chip (R.L.) (rconrad@ford.com) and Wollschlager, Paul (P.) (pwollsch@ford.com)

Ford Motor Co. uses transfer press dies that have a pneumatic cushion that have been identified as a source of premature stamping mold failure.



The cushion is a set of two pneumatically actuated cylinders mounted in the bed (bottom) of the stamping press. They apply a force on a steel box (pressure box or pad) in the upwards direction, counteracting the motion of the press slide (sometimes called ram). This box drives the cushion pins that are in contact with the part of the die that is called the blank holder. The blank holder part of the die is used for holding the blank (a sheet of flat metal), the cushion holds/pinches the edges of the blank via pin force on the blank holder die sections and the slide pushing down on the top half of the die. The parts are formed by stretching the blank over the punch (typically called stretch draw dies).

Cushion pins are used for transferring the force from the pressure box to the lower surface of the blank holder.

Cushion pins are loaded from the air pressure stored in the pneumatic cylinders that drive the pressure box.

Project Tasks:

- Review current cushion pin design and evaluate current failure modes.
- Design new cushion pins that will alleviate the failure modes and take into consideration the forming process and loads associated with it.

NOTE: Confidentiality and assignment agreements are required before students can begin work on this project.

Turkey-Shaped Mold for Sea Turtle Treats

This one is a little bit unusual….

We have been contacted by Erik Schreefel (Erik.Schreefel@merlinentertainments.biz) from SEA LIFE Aquarium in Auburn Hills. They have a couple of rescued green sea turtles here and they'd like to give them a Thanksgiving feast of sorts by freezing some of their favorite treats in a mold in the shape of a turkey.

They cannot find a suitable turkey mold (life-sized, something like 12" diameter x 18" long) of a plucked and cooked turkey and are reaching out to the SECS in hopes we can fabricate such a mold out of 3D printed plastic, sheet aluminum, or some other suitable material. It may have to be fabricated in several parts, perhaps glued or otherwise joined together, and will need to contain "*a gelatin that's full of different pureed vegetation and proteins, OR we would chop up a bunch of vegetables, fill with water and freeze.*" And, of course, it should be reusable.

This is definitely not a "normal" senior design experience but will be perfect for a couple of MEs interested or experienced in molding, sheet metal design (or in sea turtles) who are looking for an unusual challenge. The aquarium folks are not interested in any great level of detail, just something that is recognizable as the shape of a cooked turkey. They will pitch the event to media as human (and sea turtle) interest and holiday-spirit story, and to focus attention on the SEA LIFE Aquarium. Brian Bierley, Director of OU Media Relations, is very interested in following the project and documenting its development for press releases.

Since they want this for Thanksgiving (Nov 24, 2022), the mold would have to be delivered to them by early to mid-November at the latest for them to mold a few turkey treats before the big day. The senior design lab will donate the 3D printer supplies, sheet metal or whatever else is necessary, and help with ideas and troubleshooting, but it will be your challenge to pull this off for unending glory, happy turtles and priceless Oakland University press.

Sustainable Camping + Van Life Solution for Coffee and Meals on the Go

Contact Info: Jarret Schlaff, CEO & Co-founder of Pingree Detroit, Jarret@PingreeDetroit.com | 313-922-2322

Description: Action is accelerating exponentially in private and public institutions globally to combat the climate crises and innovation in EV's and Lithium battery technologies are opening up new opportunities to offer fossil free solutions to more people eager to be part of this transition. Pingree Detroit, a cooperative co-owned by Veterans and Detroiters, known for their bags, boots, and accessories manufactured in Detroit with no carbon footprint and with materials upcycled from the auto industry, has identified an opening in the market to offer a sustainable, battery powered solution to making coffee and food without the need for fossil fuels. This solution will serve campers, those living a mobile lifestyle in vans/RV's, backpackers, hunters, and those serving in our military who want to be more sustainable.

The goal of this project is to design and engineer a proof of concept of a heat coil adapter/coil plate, powered by solid state battery technology, capable of efficiently heating contents inside a container to 212 degrees in under 180 seconds. This container is widely sold but currently requires the use of fossil fuels to heat its contents. Whenever possible our preference is to use upcycled materials and those not derived from fossil fuels in the making of this proof of concept.

About Pingree Detroit: Pingree Mfg L3C(Pingree Detroit), founded in 2015, exists to train, employ, and support Veterans and Detroiters overcoming homelessness while creating products that are solutions. Our vision is to accelerate the shift towards a more sustainable, equitable, fossil free economy. We've diverted over 17 tons of leather, seat belts, and air bag material from the landfill, are carbon negative, 95% waste free, and are a worker-owned team of 9. We reinvest 77% of profits back into our workers and the communities we serve. We design and manufacture all of our goods in Detroit, MI and our founder is an OU alumni who designed and built the disc golf course and urban farm on campus while he was a student here.

NOTE: Confidentiality and assignment agreements are required before students can begin work on this project.

Razor Scooter Projects

Senior design students have been working with a local company, GEKOT, Inc., to design and implement enhancements to Razor electric scooters. Many of these projects are continuations of past senior design projects. They are listed here in order of priority, and not all are expected to run during this semester. Fields in parentheses are in order of importance.

1. **Comprehensive Alerting Technology for Scooters (CATS)** - Integration and test scooter add-on technology to address safety, abuse, and theft. (CE/EE/ME)
   This team will work closely with Professor Rawashdeh's Team to develop an innovative technology suite for electric scooters. Note that the bulk of the design effort will be provided by Professor Rawashdeh's Team. The main focus of the SDL Team will be to build, integrate, test, and calibrate the solution set.

   - Active safety- Detect riding hazards utilizing range-finding sensors. Mitigate accidents through improved situational awareness
   - Compliance with usage rules- Detect and mitigate improper usage through alarms, IOT notifications, and countermeasures
   - Visibility and audio - Improved lighting and rider alerts

2. **Open-source Control System for Light Electric Vehicles** (CE/EE/ME)

   - Motor controller development - Three-phase, brushless, hub motor control module
   - Vehicle controller development - Manage functional subsystems
   - Enclosure designs for modularity/ application flexibility and heat rejection

3. **Sidewalk Detection-** Classify riding surface utilizing low-cost sensors and machine learning (CE/ME/EE)

   - Utilize on-board accelerometer (IMU) to measure the cadence of concrete slab expansion joints.
   - Utilize machine learning to classify the riding surface to provide confidence level of "street" vs "sidewalk"
   - Develop on-board data collection system for machine learning

4. **Pedestrian Detection -** Utilize mmWave Radar technology to classify nearby hazards (CE/EE/ME)

   - Build mmWave Radar system
   - Develop "proof of concept" bench-top solution for detecting pedestrians in the scooter's path

5. **Electronic cable lock -** integrated anti-theft system tethers the scooter to a bike rack when not in use (EE/CE/ME)

- Diagnostics detect tamper or system failure
- Retail version utilizing NFC (retail scooter)
- Include a USB power input as a backup disconnect method in case of battery failure

6. **Chassis dynamometer for electric scooters** (ME/EE)

Develop a static test stand to simulate road conditions for vehicle testing and development purposes

- Design a chassis dyno for electric scooter testing
- Fit scooters of various sizes
- Able to stand on and steer the scooter while on the dyno
- Road load simulation
- Build, test, and refine an Alpha prototype
- Build, test, and refine a Beta prototype

NOTE: Confidentiality and assignment agreements are required before students can begin work on any of these projects.