The first step in developing a solution is to address the need for a device of this nature. Current monitoring devices are expensive and complicated to use. This easy-to-use device can be used in the industry to measure the heat-transfer coefficient on a surface. There is a need for a chamber that measures the heat-transfer coefficient to test various materials and surface preparations in order to find combinations that work better to remove heat. This device calculates the heat-transfer coefficient on a surface to increase efficiency and optimize materials.

This team set out to investigate the failure modes of composite joints containing manufactured-fiber structures. This group was interested in studying how manufacturing defects impact the mechanical response of composite joints. They aimed to develop an improved joint design to increase the damage tolerance of joint geometries investigated using composite material structures.

Virtually all turbines today use hydraulic actuators to control trip and throttle valves. The existing problem with using these actuators is that hydraulic leaks are frequent, which cause serious fire damage to the turbines. This team designed an electric trip and throttle valve that eliminates these health and safety issues caused by hydraulic fluid leakage. This more evolved actuator is also more reliable and efficient, and could potentially save a company millions of dollars.

This team focused on refining clean-energy technologies by fitting an existing wind turbine with an optimal load controller to improve efficiency and power generation output. A wind turbine would be used for improved efficiency in any power-generating system that has more than one parameter to control.
Industry Sponsored: Pioneer Engineering

Engine Test Cell
This device is designed to create a reciprocating load-bearing test cell to analyze the health of reciprocating machinery. It would alert users of engine falls, optimizing usage. The device can be used in every aspect of oil and gas businesses—a multimillion dollar industry, especially in Colorado. The test cell will be used to research new predictive technologies in order to prevent costly equipment failures. E.g., IPF can overhaul its pipeline engines and compressors only when the machine condition warrants it rather than on a set time-based schedule.

Challenge Project: EcoCAR 3
Innovation Team, Composite CV Shaft
This team redesigned the CV axle shafts for the EcoCAR 3 2016 Chevy Camaro, for improved performance and manufacturing using innovative design solutions and materials. The team researched the feasibility of using composite materials for mass production manufacturing to lower weight and improve car performance. This, in turn, would reduce manufacturing time and expense.

Industry Sponsored: CZERO

High-Speed Digital Valve
This team's goal was to create a high-speed valve used in a wide variety of hydraulic control applications with digital actuation, focusing on size, speed, and flow rate. This evolved valve will add efficiency and design flexibility when applied.

Challenge Project: EcoCAR 3
Mechanical Team
This year, this team's goal was to convert a 2016 Chevy Camaro to a hybrid-electric vehicle, focusing on designing, manufacturing, and testing a custom carbon fiber hood. The team also worked to modify stock suspension to accommodate the change in weight post-conversion and tested multiple mounts to package new components included in conversion.

Industry Sponsored: Boeing

High-Temperature Fluid-Resistant Coated Fabrics
The purpose of this project was to design and evaluate a thermal-fluid barrier system using the material NeXtel 312. It is flame resistant, flexible, and resistant to aviation fluids. The outcome would be a more efficient aircraft due to less air needed at the thrust for cooling purposes.

Challenge Project: EcoCAR 3
Controls Team
This team had three responsibilities—software and testing, vehicle control strategy, and vehicle integration. For software and testing, they tested Software in Loop, Hardware in Loop, and Vehicle in Loop. The team handled vehicle integration by wiring and initiating the new electric and gasoline powertrain and added three new controller area networks.

Industry Sponsored: Cummins

Composite Extruder Head Development
This group's goal was to design an extruder head to be used in conjunction with a 3-D printing machine. The extruder head will integrate with the printer to create a new method for composite manufacturing. The previous method for creating composite materials was impractical due to its lengthy and expensive processes. Composite materials are significant to the evolution of devices in the biomedical, aerospace, and energy engineering fields, due to their low weight and strength. The uses for composite materials are endless, hence this project's goal of simplifying the process.

Industry Sponsored: Woodward

Triple-Function Air Valve
This group’s goal was to design and validate a proof-of-concept air valve intended for use in military helicopters. Use of this valve will reduce overall system weight, improve the reliability of the helicopter turboshaft engine, and optimize air flow through the valve. It will also minimize leakage into the environment and other internal components.

Challenge Project: Human-Powered Vehicle
This vehicle's purpose is to gather energy from momentum of the vehicle itself and apply it to acceleration. Features include wind fairing to reduce aerodynamic drag, three wheels for stability and comfort, and regenerative braking. The regenerative braking system includes six supercapacitors to store and release energy, a clutch system to engage and disengage motor, and display of current capacitor voltage. The most significant improvement to last year’s vehicle is the use of composite materials. This device would simplify the process, making it easier to implement and more cost-effective. This design is an improvement to last year’s Siloxane Removal System.

Challenge Project: Formula SAE Electric
Although the Formula SAE team wasn't able to compete at the Intercollegiate Design Competition, it didn’t discourage this year’s team from improving last year’s vehicle with enthusiasm and tremendous skill. Each year, a team designs a vehicle, a formula-style racecar based off IndyCar and Formula One. This year, the team constructed a reliable test vehicle, serving as a design for next year's competition. Details of the design include: a chromoly spaceframe chassis, Emax 207 motor with 105 ft-lbs of peak torque and 96 percent efficiency, a high-voltage system with a 300-volt battery and 72, 3.7 VDC Melasta batteries. Cooling details include composite sidepods and an air-cooled steel accumulator case.

Industry Sponsored: Aiden

UAV Water Temperature Measurement
The EPA requires thermal pollution to be monitored, so this team’s goal was to create a cost-effective and time-efficient method to measuring subsurface water temperatures. This device acquires accurate surface and subsurface thermal measurements and images of water, and is equipped with thermal-imaging cameras and thermistors.

Challenge Project: Engine Test Cell
Industry Sponsored: Pioneer Engineering

Powertrain Team
The powertrain team was successful in designing, modifying, manufacturing, and integrating the powertrain of the 2016 hybrid Chevy Camaro. Their goals were to increase vehicle fuel economy while reducing emissions, and to optimize vehicle performance, utility, and safety. They designed a lightweight fuel tank and strap, designed to withstand 20g lateral/longitudinal forces and 8g vertical forces without experiencing plastic deformation. They also integrated a clutch actuation system design to activate clutch in under one-second. Another feature this team worked on was a custom low-profile oil pan, fabricated to accommodate the tight space constraint underneath the engine.

Industry Sponsored: Crawford

Engine Test Cell
This group was capitalizing on the thousands of landfills in the U.S. by creating a filtration system for the extraction of natural gas. Instead of extracting natural gas through traditional methods, drilling it from the ground, there is an opportunity for landfills to extract natural gas from waste, because its an expensive and complex process. This device would simplify the process, making it easier to implement and more cost-effective. This design is an improvement to last year’s Siloxane Removal System.

Challenge Project: Human-Powered Vehicle
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