Capstone Design is a one-semester senior design course in which students engage in industry projects and practice industrial engineering under the guidance of an experienced Registered Professional Engineer, as well as engineers and managers from the sponsor company. The objective of these projects is to provide economic value to the company and a practical education to the students.

The projects involve four stages of design (Problem Definition, Current State Analysis, Future State Collaborative Design, and Final Project Validation/Delivery). Students are required to perform in-depth quantitative analysis and design throughout the entire project with a group commitment of 60 hours per week for 14 weeks, and extensive on-site and web/phone company involvement to ensure success.
Sponsor: John Deere

Group members: Ross Larson, Camila Dantas, Kellie McGrath, Kevin Guinan

The team members worked on a project in the John Deere Engine Audit Lab. The audit lab is dedicated to repairing engines and auditing engines. Engines that require repair do not come to the lab on a set schedule. Rather, the lab works on these engines on an as needed basis. Repair engines are where the lab spends the majority of their time. Audited engines are scheduled to come to the lab. The purpose of auditing an engine is to ensure that the engine manufacturing process is manufacturing engines to the proper specifications. The problem John Deere faced was that it was not meeting the industry standard for how many engines to audit each year. Therefore, the team focused on increasing throughput time for repaired and audited engines so that the lab could audit more engines. The team automated an excel macro to eliminate the amount of manual writing an operator had to complete. The team added a tagging system to the storage area to eliminate no value added time searching for parts. The team added wireless keyboard stands so the operator wouldn’t have to walk back and forth to their computer stand to operate the computer. Finally, the team made future recommendations to the managers at John Deere.

Sponsor: Drake University

Group members: Alexandria Stewart, Matthew Goiffon, Michael Stinn, Alicia Wieland

In the analysis of Drake University’s College of Pharmacy and Health Sciences (CPHS), three main areas were analyzed: the Experiential Education program, the Student Affairs office’s time allocation, and the layout of the front office. The Experiential Education office’s Advanced Pharmacy Practice Experience (APPE) currently requires significant manual communication. Since this office is functioning with less people than it has in the past, it has become more difficult for the staff to manage. The main concern within the Student Affairs office regarded the staff and their job functions, with the majority of their time being spent on emails, in meetings, and with face-to-face communication. Lastly, the current layout has inefficient flow and poses as a source of distraction to upwards of four people each time someone enters the welcome area.

The objectives of this project were to decrease workload and reduce the time spent on non-value added activities within the Student Affairs and Experiential Education offices. In part, this was to be accomplished by improving communication with students. Another objective was to adjust the visitor flow within the Student Affairs office and decrease unnecessary distractions to the employees.
Sponsor: Seneca Tank

Group members: Justin Danko, Daniel Thayer, Emilee Nyberg, Matt Ehresmann

A student group worked with Seneca Tank on the Ready-To-Deliver 2700 tank truck. Seneca Tank is located in Des Moines and is an international supplier of new and used petroleum tank trucks, transports, and truck tank parts. The students made recommendations to the company that would increase efficiency in the assembly process and introduce kits with standardized parts into the production process.

The team addressed issues with variability in Seneca Tank’s manufacturing process of the Ready-To-Deliver 2700 tank truck, and had a one-year economic payback of $600,000.

Sponsor: Vermeer

Group members: Andrew Sonquist, Natalie Richardson, Nick Hennessy, Hannah Huber

Vermeer Corporation is focusing attention on the round baler production process to ensure safety of front-line employees and to decrease baler belt installation time. The primary goal of this project is to design a tool or process to correct ergonomic challenges which will be applicable to multiple baler types. The secondary goal is to implement time saving improvements for baler belt installation.

The results of the ergonomic assessments the team conducted during the Current State Analysis support Vermeer’s initial theory that the operator’s body is at risk throughout baler belt installation. The scores from the Rapid Upper Limb Assessment (RULA) and the NIOSH Lifting Equation suggest alterations to the belt installation process are necessary. The team’s goal is to meet or reduce the current time to install the belts with changes to current state.

First, the team designed a rack to hold the baler belts for transportation from the vendor to the assembly line. These racks will reduce the strain on the operator’s body when transferring the belts from the rack to the belt spindle. Second, the team designed a process to feed the belts through the baler that will minimize the physical strain on the operator. The project design will reduce the scores of the RULA and completely eliminate the belt-lifting process which quantified as high risk to the operator according to the NIOSH Lifting Equation. This will help eliminate the risk of injury to the operators and unwanted cost to Vermeer. A recognizable savings of at least $10,000 annually is anticipated with the implementation of these new designs.

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Why participate in capstone?
In Spring 2016, 15 projects were performed at 15 different companies. These companies were asked to provide their personal realistic estimate of the economic value of their student projects. The project values ranged from $25,000 to over $2 million with an average value of $936,000. Four projects exceeded $1 million in financial impact. Since these projects cost $5,000 per company, the average returns are substantial. Companies agreed to implement between 70% and 100% of student recommendations, and on average was 80%. Over 85% of our students have industry experience, and 25% have international experience, prior to working in Capstone. These engineers are mature, experienced and motivated, with extensive oversight.

What types of projects?

What is new?
Intense focus on achieving BUSINESS VALUE in mostly economic terms. Objective is to leverage solid engineering fundamentals packaged within a systematic workflow to deliver results with an independent and objective perspective.

What is my commitment?
A minimum of two projects per semester for two semesters. Some companies could only do spring. Payment, subject to your satisfaction, is $5,000 per project (covers travel and up to $500 in materials). Students and faculty are able to sign NDA and IP agreements. You would need to assign a project manager for each project and ensure that this manager has the time, ability and resources to assist the students with access to data and facilities in a timely manner. Since this is a fee-for-service project, the $5,000 is not a tax deductible expense.

How do I get started?
Contact Dave Sly, at 515-450-2335 or davesly@iastate.edu. www.imse.iastate.edu