How to sponsor a
SUCCESSFUL CAPSTONE DESIGN PROJECT

**FOR MORE INFORMATION OR TO DISCUSS
YOUR PROJECT IDEA, PLEASE CONTACT:**

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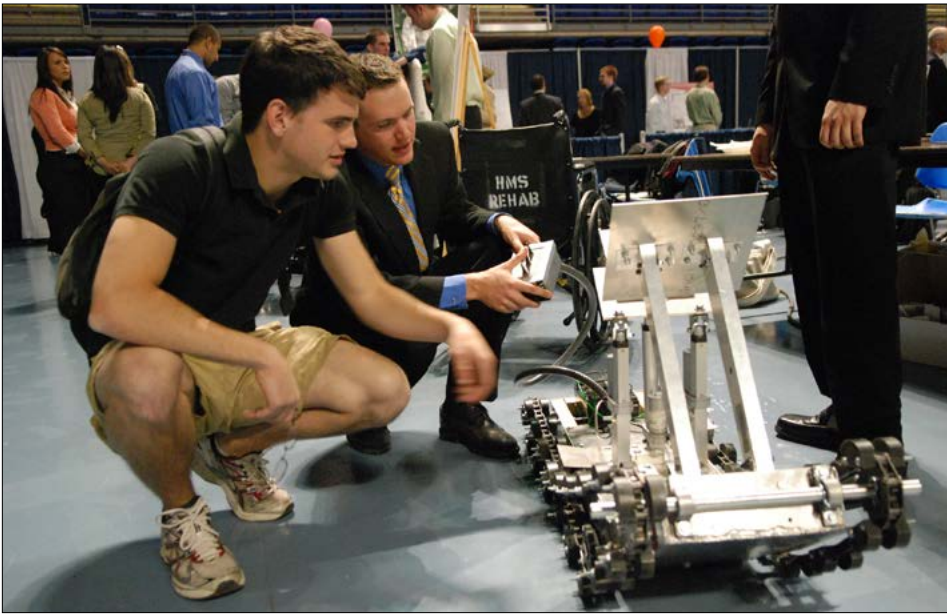(e) jjt5008@psu.edu | (p) 814-863-1229

Check out our website to review summaries of completed
projects and to submit a project electronically:
lf.psu.edu

PennState
College of Engineering | LEARNING FACTORY

OVERVIEW

The Learning Factory capstone design projects involve students from 11 different programs in the College of Engineering and the College of Earth and Mineral Sciences at Penn State:

- Biomedical Engineering
- Computer Engineering
- Computer Science
- Electrical Engineering
- Energy Engineering
- Engineering Design
- Engineering Science and Mechanics
- Industrial and Manufacturing Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Nuclear Engineering

Together, the departments collaborate to offer an industry project course. This course is typically taken in the final year and is the culmination, or "capstone," of the students' academic careers. The course requires students to demonstrate the ability to apply their rigorous training in engineering science, design, and project management by executing a real-world project defined by a client. Through the Learning Factory, students complete about 220 projects per year.

PROJECT EXPECTATIONS AND DELIVERABLES

Each project typically involves a team of four to six students over a 15-week semester. Considering that the students will also be taking other courses at the same time, this equates to approximately 400 student hours of effort devoted to the project. Results from student teams are highly dependent on the nature of the project, the innate team capabilities, the amount of client interaction and support, and many other variables. No guarantees can be made, other than that the students will give it their best effort. Often, a project provides direct and immediate benefits to the sponsor. Many projects result in good concepts that require further work (either by a follow-on project, or by the sponsor's in-house staff) to bring the project to fruition.

Benefits to Industry Sponsors

Collaborating on a project with Penn State students and faculty has several direct and indirect benefits to the industry sponsor:

Fresh ideas, out-of-the-box solutions to real problems

Low-cost, low-risk investigation of "back-burner" ideas

Identifying talent for employment

Corporate exposure on campus

**Project management experience for your junior staff engineers**

Improving engineering education at Penn State

Networking with other industry professionals and Penn State faculty

Deliverables to the sponsor may include some or all of the following:

1. Reports, feasibility studies, design analyses
2. Solid models and engineering drawings
3. Prototype hardware
4. Software and data
5. Manufacturing or service delivery process plans
6. Presentations, videos, demonstrations
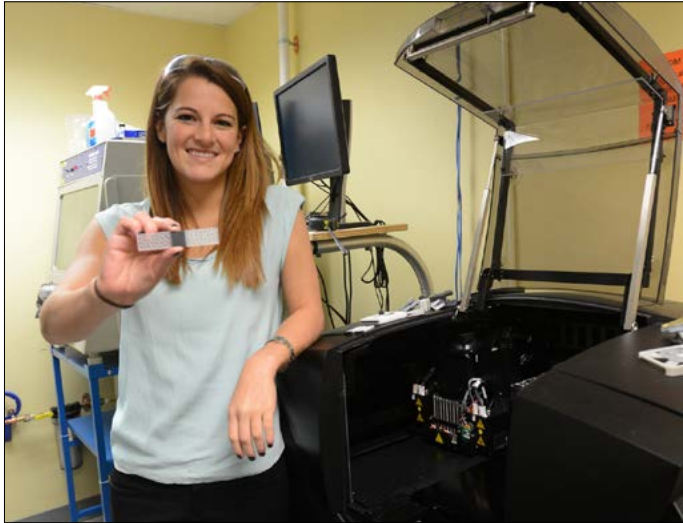
AVAILABLE RESOURCES

Project teams may draw on the expertise of faculty instructors and state-of-the-art resources from across the College of Engineering, including the Learning Factory facility. The Learning Factory provides complete facilities for prototyping:

- **3D Printing:** Stratasys Objet, UPrint, Dimension 1200 SST, Maker Bots, Mcor Arke, Xact Metal

- **Computer-Aided Design and Analysis Tools** such as SolidWorks, project management and simulation software for various applications

- **Metalcutting:** 3 axis Bridgeport CNC machining center, CNC lathe, OMAX Waterjet cutter, milling machines, lathes, drill press, saws, grinder, bead blaster, sheet metal-working

- **Welding:** MIG, TIG, gas

- **Other:** CNC router, laser scanner, electronic stations

Other college facilities can be made available as needed, including: metal-casting foundry, materials testing, vibration and acoustic test facilities, engine testing, and composite material processing.

Sponsor Requirements

A successful industry-based student design project requires that the sponsoring organization assign a motivated individual to oversee and interact with the students throughout the project duration. The most critical factors to a successful project are communication, and a minimum commitment of one to two hours per week as well as attendance at two on-campus events. The sponsor is expected to do the following:

- Attend the Project Kickoff meeting of all project sponsors and eligible students during the first week of the semester.

- Provide more detailed information than the initial one-page summary.

- Facilitate visits by the students to the sponsor's location. The first visit should occur as early as possible.

- Interact regularly (weekly or more frequently) with the students at the sponsor's site, at Penn State University Park, by email, telecommunication, and/or video conferencing.

- Review reports and provide feedback from the industry point of view (e.g., progress reports, project proposal, design analysis, final report).

- Evaluate the students' performance mid-way and at the end of the semester, which is part of their final grade.

- During the last week of the semester, attend the on-campus Design Showcase where all the student design projects are on display.

- Demand constant professionalism and a high level of performance from the students.

Project Submission

Careful consideration and early collaboration between the sponsor and Penn State faculty are crucial to the development and execution of a successful student project. All that is needed to begin the process is a one-page project description, which details the contact information, objectives, motivation, and deliverables for the project. This is entered and submitted electronically by the sponsor at **www.lf.psu.edu**.

To guarantee consideration, the form should be submitted by the deadline posted on the Learning Factory website. The project descriptions from all the sponsors are publicly available online, from which the students indicate their preferred projects. The catalog for the current semester is at **tinyurl.com/lf-current-projects**. Since project selection is voluntary, care should be taken in composing the project description to make it attractive and interesting.

SELECTION OF STUDENT TEAMS

Teams are determined the week before classes. The Project Kickoff event will be held the first week of classes and includes a sponsor meeting with the director of the Learning Factory. It will also serve as the first technical meeting for teams and sponsors. Teams of four to six students will be selected based on three factors: the students' project preferences, the majors that are requested by the sponsor, and the students' class schedules. We make every effort to honor the sponsor's requests for particular majors, but we cannot guarantee it.

We strongly recommend that sponsors attend the kickoff event. If it is not possible for you or a representative to attend, then you must arrange a first technical meeting with your team during the second week of classes. This may be appropriate if a site visit is critical to the success of your project, and the student team is invited to your location during that timeframe.

PROJECT MANAGEMENT

Students are in their final year and are enrolled in a capstone design course. Penn State faculty supervise the student teams and the industrial sponsors serve as mentors to the team. A typical schedule for a 15-week semester project is shown below. Note that this is only a general guideline and may change due to specific project requirements.

15-WEEK SEMESTER SCHEDULE

WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5
Project kickoff/ first technical team meeting	Visit sponsor	Visit sponsor		Project proposal to sponsor
WEEK 6	WEEK 7	WEEK 8	WEEK 9	**WEEK 10**
Proposal presentation to sponsor				Design review
WEEK 11	**WEEK 12**	WEEK 13	**WEEK 14**	**WEEK 15**
	Prototype completion		Final report and poster completion	Final project presentation

DESIGN SHOWCASE
at Penn State

FINANCIAL COMMITMENT

The project donation is $4,000 per project. The cost for a second team working on the same project is $2,500. Data show that having two groups work on the same project is highly desirable. This inspires competition between the teams, allows multiple solutions to be explored, and more than doubles the output for a minimal additional investment of money and time. Donation for a global project is $4,000 per project. Since this is a tax deductible, charitable contribution to the University, no guarantees can be made of project outcomes. Each team is given a working budget of $1,250. The budget covers basic project expenses that are required to complete the project such as supplies and prototyping materials, presentation materials, and travel expenses to the sponsor's location. The remainder of the fee is used to cover the operating costs of the Learning Factory and the participating departments. The sponsor is expected to supply any necessary resources that are not already available at the University. When this situation arises, students are expected to justify them by written proposal to the sponsor. Teams will only be permitted to purchase items required for use in the current semester of the project.

INTELLECTUAL PROPERTY AND CONFIDENTIALITY

Intellectual Property Ownership: For an additional administrative fee, sponsors may also request ownership rights to all intellectual property that is developed by the students during the course of the project. Projects in this category require students to assign their intellectual property rights to the sponsor (see **tinyurl.com/lf-property-rights**). All materials, reports, and documents produced by students must be available for their personal use. Requiring the IP agreement may discourage students from selecting the project.

Confidentiality: For an additional administrative fee, sponsors may request that the student team sign a confidentiality agreement. With regard to company-provided information (data, drawings, design details, etc.) required to execute the project, students and University personnel agree to abide by the terms and conditions of the non-disclosure agreement (NDA) (see **tinyurl.com/lf-non-disclosure**). Note: The NDA is void after two years. Prior to public disclosure of information including reports

and display poster, students agree to provide sponsors copies of any proposed documents for sponsors' review and comment. Upon request of sponsor, students agree to remove all information identified as sponsor's confidential information. All project results are made available to the sponsor. As with the IP agreement, all materials, reports, and documents produced by students must be available for their personal use.

DESIGN SHOWCASE

During the final week of the semester, students display their finished work at the Design Showcase. This event is the major exposition of student projects for the College of Engineering. Typically, more than 100 projects are displayed, ranging from first-year through graduate course projects, and including the Learning Factory capstone projects. Lockheed Martin sponsors an award for "Best Project" and BP sponsors an award for "People's Choice." Winners are judged by representatives from industry. The Design Showcase is also an excellent opportunity to recruit new talent and to network with other industry professionals and Penn State faculty.

TIPS FOR SPONSORS
Getting the most from your student team

VISITS

Students should visit their sponsor as early in the semester as possible. This helps them get a clear understanding of the project and to meet your employees. While they are there, give them a tour and let them meet as many of the relevant engineers, technicians, and machinists as possible. A second visit later in the semester (perhaps for a mid-term design review) is also encouraged.

REGULAR COMMUNICATION

Direct, regular communication is essential. Bi-weekly conference calls in addition to the weekly email progress reports are recommended. Student teams and sponsors are encouraged to communicate by email. Please provide prompt acknowledgment and feedback after receiving the weekly progress report.

DEMAND PROFESSIONALISM

With your help, we are trying to teach these students what it is like to be a practicing engineer. Expect the same excellence and professional behavior exhibited by your own employees. If they do not perform to your expectations, notify them and their instructor immediately.

COMMITMENT

Clearly identify one contact person who has a good understanding of the project, is willing to spend time with the students, and is available throughout the semester. Attendance at the Project Kickoff lunch and at the end-of-semester Design Showcase is highly recommended. The contact person should be committed to the project and take an active role in providing feedback to the students. They should be willing to spend time answering student questions and providing feedback. This should take no more than one or two hours per week, on average.

CLEAR, STABLE DELIVERABLES

The sponsor must be clear on the objectives and deliverables for the project. These deliverables should be discussed, refined, and agreed upon in the first few weeks of the semester.

PROVIDE ADDITIONAL INFORMATION

The sponsor should provide more detailed information about the project than the initial one-page summary. The sponsor should keep in mind that the students don't have easy access to the same information the company employees do (e.g., part drawings, dimensions, company specific information) and be willing to expedite transfer of that information to the students.

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