A Comprehensive Strategy for Recruiting Externally Funded Capstone Design Projects

Gregory Watkins
California State University Chico

Capstone design experiences for engineering students are nearly ubiquitous in today's engineering curricula, primarily due to accreditation requirements that require students to "be prepared for engineering practice through a curriculum culminating in a major design experience."

A common model is for students to work in teams on design projects put forth by industrial sponsors. These projects provide a real-world design experience for the students along with many other benefits. Depending on the discipline, funding is often necessary for a complete design experience that includes fabrication and testing of the students' designs.

A common issue for faculty delivering capstone design courses is the recruitment of externally sponsored projects. While some institutions employ someone outside the faculty to recruit projects, at others it falls to the faculty member teaching the course. This often requires work during periods that are not otherwise compensated, such as summer or winter breaks. It also requires skills in communication and sales that may not be a strength for some engineering faculty.

This paper details a comprehensive strategy for recruiting funded capstone design projects from external sponsors. The goal is to pass on best practices learned through a multi-year process of establishing a new model of externally funded projects in the Capstone Design Program at California State University Chico.

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Corresponding Author: Gregory Watkins, gkwatkins@csuchico.edu

Background

The mechanical and mechatronic engineering programs at California State University Chico are accredited by the Engineering Accreditation Commission of the Accrediting Board for Engineering and Technology (ABET). The criteria to establish and maintain accreditation are set forth in the document titled *Criteria for Accrediting Engineering Programs.*[1] A specific criterion of importance here appears under Criterion 5, Curriculum, which states that "students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints."

As with many engineering programs, this criterion is met via a specific course in capstone design. Mechanical and Mechatronic Engineering programs conclude with a single, two-semester, multi-disciplinary capstone design course that is cross-listed for students in both programs.

Sources of Projects

While the ABET criterion does not address the origin of design projects, it does require that students complete a "major design experience" that is intended to prepare them for professional practice. Many institutions have implemented capstone design models that include projects from outside industrial sponsors. This appears to be a continuing trend.

Todd, et al. initiated a survey[2] of capstone engineering courses in 1994. A follow-up survey[3] was accomplished by Howe and Wilbarger eleven years later. Both surveys asked respondents about the sources of design projects in their programs. The 1994 survey offered three possible responses which are listed below, along with the resulting percentage selecting that response (multiple responses were allowed):

- Industry – 59% of respondents
- Internally – 58% of respondents
- Other – 15% of respondents

The 2005 survey offered six possible responses which are listed below, along with the resulting percentage selecting that response (multiple responses were allowed):

- Industry – 71% of respondents
- Faculty Research – 46% of respondents
- External Competition – 24% of respondents
- Student – 15% of respondents
- Book – 6% of respondents
- Other – 21% of respondents

The data clearly show that institutions are increasingly utilizing design projects from industrial sponsors in their capstone courses. What is apparently missing from the literature is any sort of "how to" guide for recruiting these industry sponsored projects.

A New Paradigm

California State University Chico has long had a senior design course in mechanical engineering, which expanded to include students in mechatronic engineering when that program was developed and initiated in the early 2000s.

Prior to the 2007/2008 academic year, design projects were obtained informally from a variety of sources. Some were generated as part of faculty research, some were competition based, and many were simply suggested or brought in by students in the class. There was no formal recruitment of projects from industry, though some were obtained through various means.

Based on the study of successful programs at other intuitions, an effort was initiated in fall 2007 to specifically recruit projects from industry. This nascent endeavor was initiated by a new faculty member with limited experience in capstone design programs, no experience in recruiting design projects, and questionable competency in the soft skills necessary to succeed in sales, which in its essence, is what project recruitment boils down to.

Eight years later, the pride of the department and a highlight of its engineering programs is a mature, established, fully funded Capstone Design Program in Mechanical and Mechatronic Engineering.[4] In the current year, the program serves 103 students working on 21 projects with over $80,000 in external funding from numerous public and private industrial sponsors that run the gamut from small local fabricators to government facilities to multi-national billion dollar corporations.

Over those eight years, much was learned about the successful recruitment of industry-sponsored capstone design projects. As might be expected, much more was learned about the unsuccessful recruitment of those same projects. This collective experience has resulted in the following comprehensive strategy for recruiting industry-sponsored design projects. It is hoped that the information and techniques described can be adopted and utilized by other institutions that are pursuing industry sponsored projects in their capstone programs.

How Much Should We Charge

Before presenting specific recruitment strategies, the subject of what to charge for projects deserves discussion. Our initial model called for sponsors to provide funding only for materials needed to build and test the design. And since those costs were unknown until a mature design was developed, funds were not requested until well into the school year.

This was a failure on several levels, and is highly discouraged. Sponsoring organizations nearly always underestimate the funding required to produce a design. One in particular did some cursory research and concluded that a bridge crane hoist could be produced for about $1000. The final tally coming in at three times that amount led to some long and difficult discussions, and led to the sponsor never again participating in the program.

In another case, in between the time the project started and the funds were requested, a sponsor incurred a significant fine for violating environmental regulations and simply could not pay. This left the project team in a very bad situation, having to significantly de-scope their design and fund-raise to complete it.

A sponsorship fee that exceeds the anticipated cost of fabrication by at least 50%, and is collected up front, is recommended. Our base fee of $5000 has worked very well. We allow up to $3000 to be budgeted for project expenses with a $500 contingency. If additional funds are required for costly components, we either request additional funding from the sponsor or have them purchase the equipment directly.

There are many advantages to this model, three of which are highlighted here. Primary is that the students have sufficient funding to produce a quality design that (usually) works and shows well. Secondly, the flat fee discourages sponsors that are mainly looking for free labor to build their latest idea. Finally, the surplus funding is valuable for supporting the program, as well as the faculty member that coordinates it. Funding balances support general fabrication assistance from our technical shop, pay for food and hospitality at our events, and provide summer salary for the faculty member that recruits the project.

Project Recruitment Strategies

While not intended to be a step-by-step guide, the following suggestions do cover many different areas related to project recruitment, and taken together, hopefully provide a comprehensive strategy for recruitment of externally funded projects.

Build the Database

An important step for successful, ongoing, project recruitment is to build a database of potential sponsors. It

is also critical that the entry include a key contact within the organization, preferably a mid-level or low supervisory level engineer. The ideal contact is someone who can approve funding, and also suggest and encourage staff engineers to be the eventual point of contact for the design team.

There are many sources that can be leveraged to develop these contacts. First and foremost would be industry contacts from senior faculty, chairs, or deans that have been with the university for an extended period of time. Many will have a "rolodex" of contacts that might be potential sponsors.

Another source is the university's career center, and whoever manages contacts for their career fairs. While these company representatives are often in human resources rather than engineering, they can still be a path to a more appropriate contact within the company.

Most accredited programs have advisory boards, and present and past members are not only good contacts themselves, but often can make recommendations of others.

Finally, most departments have some sort of alumni database that can be a great source of contacts. Our own institution has a tradition of graduates sending in their business cards, which are displayed prominently in the hallway outside the department office. It is not only a great motivator for current students to see the possibilities ahead of them, but is an excellent source of contacts for future project sponsors.

Promote the Program

Two staples of promotion that are highly recommended are a program website and high quality brochure. Whether reaching a potential sponsor by phone, email, or in person, these tools can be very valuable, and also save a tremendous amount of time in the long run.

Most universities have standard web page templates and/or staff to assist with creating university web pages. While some engineering faculty are undoubtedly proficient web designers, many are not. But most should have access to resources to help build a web presence for the program. The content of our program website[4] has evolved over time, with much of it generated to answer questions that frequently come up during project recruitment. Key recommended content areas are discussed below.

Past Projects – Many new potential sponsors will ask about typical projects, trying to get a feel for scope and whether something they have in mind would be appropriate. Our program requires final presentations as well as posters that summarize each project. We recommend that the presentations include video where appropriate to show the design's operation. These items are collected from all teams at the end of the year. Select projects from each year are then highlighted on the website, including the presentation, poster, and any video. This not only gives potential sponsors an idea of project scope, but is also a great tool to show off the program and highlight better known sponsors with name recognition that enhances the program's reputation.

Other recommended content areas include explanations of funding, liability, intellectual property, and other details that are the subject of frequent questions. Calendar items, such as the dates for presentations, expos, and the like should also be included. Finally, a Frequently Asked Questions (FAQ) is suggested that can be expanded over time.

The other strongly recommended promotional item is a high quality program brochure. This is the time to spend some of the left over sponsor funds, as a high quality brochure is not inexpensive to develop and produce. Most institutions employ artistic staff in their marketing departments, and many are available to do university related work for free or at a reduced cost. Marketing is an area in which many engineers do not excel, and it is often difficult to recognize that others are better equipped for this type of work. A high quality, impactful brochure, printed in color on high quality paper, can be a very valuable recruiting tool. They can be handed out at career fairs, direct mailed to target sponsors, and left with sponsors after an in-person visit. The brochure developed for our program can be viewed and downloaded from the program website.[4]

Show Up

When contacting potential sponsors, whether by cold call or email, an important way to communicate the value and credibility of your program is to suggest a visit to their facility. This is time consuming and can be expensive, depending on distance, but is an extremely effective way to secure a project. This is best done during the summer, and is made possible by excess project funds that support travel and faculty salary, as discussed earlier. Senior staff at many companies are often pleased that a university faculty member has taken the time and effort to visit. On most occasions, the company will schedule meetings with staff engineers, supervisors, and upper management. While it is not a guarantee, if a company can be persuaded to host an in-person visit, the probability is high that they will also choose to sponsor a project.

Show Off

An important aspect to project recruitment is showing off the program. Many successful capstone programs have end-of-year events or expos that include hardware display, presentations, posters, etc. Students are encouraged to dress professionally, and to professionally present their projects.

These events are fantastic recruitment tools for potential sponsors. Invitations and reminders should be

sent to every contact in the database. Seeing the quality of the students' work, and the pride they have in it, are of immeasurable value in convincing a sponsor to participate during the next cycle. Getting them there, is of course, the challenge. One successful strategy we have employed is to invite key potential sponsors to serve as judges for our "Outstanding Project Award."

In addition to potential sponsors, efforts should be made to invite local media, both print and news, as well as the local Chamber of Commerce, along with any economic development agencies located within a reasonable distance. Our institution is in a sparsely populated, largely rural area, but we have been successful recruiting projects from near and far to our program.

Sell the Students, Not their Work

Many potential sponsors initially see capstone programs as a way to get some low cost engineering work done. It is important to present the program in broader terms, and especially emphasize the value of potential employee recruitment. Point out to the sponsors (and to the students in the class), that the student team is essentially on an eight-month job interview. If a sponsor is interested in hiring, sponsoring a capstone project is an outstanding (and inexpensive) way for them to get to know four or five students and decide which ones might be a good fit at their company.

Interns to Projects

Along the same lines, a great source of projects can be the career center and students that are interning at companies before their senior year. Our program has a policy that if a company already has a relationship with a student in the class (such as he/she working there as an intern) and sponsors a project, the student in question will automatically be assigned to that project team. This allows the employer to continue a relationship with the intern, and also gives them continuity in work, as the project topic is often related to work the intern was engaged in. This can also motivate an interning student to convince their employer to sponsor a project, as that is the only way for a student to be guaranteed a particular project. This tactic has resulted in two to three projects per year that likely would not have happened otherwise.

Keep the Sponsors You Have

One of the easiest ways to secure a project is with a repeat sponsor. While this is seemingly obvious, there are many measures that can be taken to increase the likelihood that a sponsor will repeat in the next cycle.

An important activity for the program coordinator is to keep tabs on projects, and contact sponsors a few times during the year. While all projects in our program have faculty advisors that are regularly in touch with sponsors, a check-in from the program coordinator is often well received.

There are also some recommended activities at the end of the project period. The end of the semester is a very busy time for most faculty, and once grades are complete, it is tempting to simply move on to summer break. But it is highly recommended that sponsors be acknowledged and thanked once the project is over. If possible, an in-person visit to hand deliver the report, hardware, student log books, etc. is the best approach. The materials should also be accompanied by a letter of thanks on university letterhead. This personal touch makes the sponsor feel appreciated, and much more likely to sponsor again in the future.

Maintaining the Program

All students graduating from our program are strongly encouraged to connect with the program coordinator via LinkedIn.[5] As graduates move into the workforce, and work their way into positions of responsibility, they become excellent contacts for future projects; and LinkedIn is an excellent means to maintain contact with them. Alumni especially appreciate what the program did for them, and are much more likely than non-alumni to be receptive to sponsoring a project. Oftentimes these alums will be the point of contact at the sponsoring organization, which has the added benefit of exposing current students to the kind of work they may be doing in the future.

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