



Industry Partnerships Assist Programs for Accreditation

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Educating engineering students is rewarding and challenging. It is an exciting time to be an engineer and engineering educator, but with limited resources and reduced budgets, finding more opportunities to support academics is not an easy task at a primarily teaching institution. As a result, looking outside the institution and traditional resources can promote multiple engineering programs, add relevance, and connect industry to academia. Connecting industry partners to the institution has helped in organizations meeting their community service project goals, filling both internship and full-time employment needs, adding academic expertise to solve some technical problems, and can be an effective part of a college recruiting plan. Students benefit from seeing the relevance of their academic work to real world problems, exposure to industry professionals and employment opportunities, and exposure to equipment the institution does not have. The industry benefits from access to the pipeline of future employees and great marketing.

This paper presents how one university develops and uses industry partnerships to provide a number of different academic resources. These resources support capstone projects, advising and evaluation of capstone projects, research projects as well as financial support for the projects, adjunct professors, dedicated internships and active members for advisory boards providing financial support and curriculum input. In a time of ever decreasing resources at the state level, public universities are moving to operate similarly to a private institution. Additionally, during these times the building of new programs requires the leveraging of the resources of private organizations. Analysis of examples of program development and enhancement using industry partnerships will provide a number of best practices.

Introduction

Industry involvement in academia started with research. Many professors after World War II were either teaching focused or research focused. One of the authors' advisors in graduate school researched, tested, designed and assessed annually the Trans-Alaskan Pipeline – an industry and governmental generated project. Discussions surrounding his work highlighted that many peer faculty were researching solutions for the United States industrial base that was greatly expanding even after its growth during the war. Over time state and federal governments expanded their role and expenditures in the area of research such that today 13.6 percent (20 percent increase from 2017) of the 2018 Federal budget supports research [1].

With the expansion of ABET accreditation requirements through the engagement of discipline-specific professional societies, the role of the advisory board grew to include the need for comprehensive curriculum reviews with an eye on regionally specific strategic needs for the university [2]. With the push for capstone projects, the need for external assessment by practitioners as well as industry partnerships grew to enhance the authenticity of projects the students experienced prior to graduation. However, it was the most recent recession that greatly decreased the state resources flowing to universities that has heightened the need to grow industrial partnerships to further develop financial partnerships [3]. This paper will focus on the expanse of industrial relationships that allow the School of Engineering programs to financially and effectively operate and meet accreditation requirements.

Industry Partnerships Usually Considered

Industry Boards. The obvious industry partnership that is an accreditation requirement for all engineering programs is an Advisory or Industry Board or Executive Committee. There are numerous names given to these boards and many are based on regional or university regulations or traditions, but those at the program level focus primarily on accreditation requirements: review and approval of mission statement, vision statement, Program Educational Objectives, Student Outcomes, and curriculum focus beyond outcome and program criteria requirements to meet industry needs. Some advisory boards review the type and quality of capstone projects to address the current skill sets taught and then used in the capstone as well as needed by current and future graduates. It is crucial to capture in the advisory board minutes when they review, discuss and approve each area since these are needed to validate the assessment process for the ABET accreditation team. Advisory boards at the college or school level should never be focused at the programmatic level as some operate at. Instead, they should operate at the strategic level looking at how engineering in general is changing, what changes are needed to move in that direction, and to assist in locating/developing the resources to support the desired changes. Of course, the same strategic focus is true for university level boards that operate at the governing level, but many are used primarily for fund raising.

In 2011 in The Citadel School of Engineering, the departmental program level boards were focused only on curriculum issues while the School level board was also focused on curriculum. It has taken six years to transition the program advisory boards to also consider small-level discretionary fund raising as an additional board requirement. The recession driven decrease in state funding and foundational endowments decreased the level of student development funds by 50 percent that could only be replaced quickly by discretionary funds. Many members of the boards did not see fund raising through their gifts or others as something they wanted to do, so many have been replaced. The same adjustments were required at the School level board. None were asked to fund raise when asked to join the board. Of course, there were a number that had been waiting patiently for the ask and were surprised when there had been none. Some members were replaced to ensure the board focused on mid to high-level discretionary fund raising. These changes have led one program level board to endow a scholarship and the School level board to endow a scholarship and to jump start concept design and fund raising for a new academic engineering building. The key on the adjustments was a larger focus on fund raising and to have board members add appropriate wording to the board charter as well as challenge others to an annual gift amount. Funding for student capstone projects and competitions are critical components to accreditation.

Capstone Projects. For two decades, the ability to develop a capstone that accurately resembles the requirements that future graduates will face has been supported by industry supported capstone/senior project ideas [4] - [7]. Many of these are projects that may not have been successfully contracted by industry. However, there is enough work done by the industry partner to develop a thorough problem statement, and normally provide input at critical stages (therefore, act as the employer) for these capstone teams. Another possibility is that the project is something of lower priority or in the concept phase only that the industry partner possibly wants to work on,

but does not have the time and people. The student teams can/will produce initial concept designs that can greatly inform the industry partner on whether to invest more time and people into the project and/or they can start at a more advanced concept design when they do start the project.

Local companies, municipalities, state Department of Transportation, and the local Medical University provide projects to the School of Engineering that are administered in a variety of effective ways. In the case of smaller design projects, faculty prepare the industry input for presentation to the students in the first week of the fall semester and students can sign up for a given project. If multiple student teams want to work on a project, the originator of the project is contacted to determine if they want to work with more than one team. If not, the teams present their ideas and why they are the best qualified team for the project to the faculty advisor and the originator who then select the team. The other team(s) must then apply to work on other projects. In the case of larger development project, the faculty generate partners with municipalities and design engineers to provide relevant site specific data to include survey data, utility locations, and wetland delineations to list some examples. Students are broken into multiple teams. Industry partners (i.e. state and municipal engineers, state and federal regulators, and multidisciplinary consulting engineers) provide input and feedback to the student groups to help inform and guide their designs. At the end of each semester, each student design team presents their designs to the board of the industrial partners which significantly benefits the student learning and further supports the benefits to industry identified earlier. Timely real-world projects are critical to preparing students to be best prepared to enter the workforce - industry contacts are the best source.

Internships/Co-Ops. Most companies look to pay it forward by hiring students to complete internships during the summer. The hope is to hire the best themselves and prepare others for the overall industry. Of course, there are some industries that only use Co-Ops (student interns for a fall or spring semester tied to the summer as well – 8-month long employment) to hire students as interns as well as fully hire them.

At The Citadel where day students are fully residential and have military and physical requirements daily, the internships have been generally limited to the summer months only. However, those students completing a fifth year live off campus and generally do not have a full load (12 credit hours) to complete. The evening only students completing the 2+2 program where the last two years are at The Citadel (taking courses fall, spring, and summer to graduate in two years), normally work part-time while taking all courses in the evening from 5:15 till 9:30. Both of these populations are highly recruited for employment during the academic year as they are the only groups that are available. These students complete 15-40 hour weekly internships based on their course load. However, with recent changes to align with other senior military schools, the juniors and seniors not under military contract nor working to obtain a contract are moved from an ROTC (Reserve Officer Training Component) course each semester to an ROTC-Fulfillment course. These are academic courses with a focus on leadership in an academic discipline. With the growth of experiential learning which provides the opportunity to lead and use obtained skills, internships are included in the list of potential ROTC-Fulfillment course. Of

course, a traditional internship while taking a full load is a daunting task therefore part-time internships are considered. The requirement for internships courses has been developed to work in this environment. The current requirements are 120 hours of work over 15 weeks, or 8 hours per week. This can be too little for a firm to engage a student, but many local firms are seeing this as a unique opportunity to hire five students for the price of one to work on numerous small projects that the firm does not have the time nor people to dedicate. This relationship during the semester is strengthened if the student was able to work for this company full time in the summer and is continuing during the semester by engaging in the ROTC fulfillment alternative. In these cases, companies are familiar with the student and the student has already gone through the initial learning curve familiarizing themselves with the company's standard operating procedure.

In order to allow students to be competitive with industries only using Co-Ops for hiring, exceptions have been developed to allow residential day students to participate in a Co-Op. Those students interested must be selected for the Co-Op in the spring so they can inform the administration and ensure they switch to taking courses with the evening program in both the summer and fall. The Co-Op is limited to 25 hours of work versus the usual 40 hours to allow the students to stay on track to graduate in four years with peers which is important to students in a cohort military focused school. An internship or Co-Op is critical to enhance hiring upon graduation.

The Citadel has a large number of veterans who are normally looking to work part-time to fill in the financial gaps not covered by the GI Bill. These students are available all 12 months, but the real discussion moves to what about the incredible students we have under contract to enter the military. Not all enter active duty, but serve in the Reserve and The National Guard. They will need to do military training sometime in their first year, but generally the rest will be completed two weeks a year and one weekend a month. These students are training for at least two weeks each summer, so companies are asked to allow these students to work only 8-10 weeks as an intern (maybe not consecutive weeks) versus the normal 10-12 weeks. Some of our most talented students are wanting to serve in the military in some capacity. Without a focused discussion, they are excluded from most internship opportunities. Additionally, some of the students desiring active service will not be commissionable for a variety of physical reasons discovered at the physical in the second semester of senior year that would not interfere with working as an engineer. Without internship opportunities each summer while also completing the two weeks of training, they will not be as prepared to enter the engineer work force. Another key reason to engage the industrial complex is the preparation of those who will be serving on active duty – truly paying it forward.

Field Trips. Many courses are enhanced through a field trip to bring the content to life such as in structural steel design, structural concrete design, geotechnical engineering, traffic engineering, wastewater engineering, etc. Sometimes onsite construction activities are not suited for a visit or the timing of the visit is key to observe key academic concepts (i.e., structural or concrete columns covered by metal studs and sheet rock). Today, many companies have developed K-12 or even better K-16 outreach goals for their employees, so these field trips are now able to count toward outreach requirements while assisting the faculty to visualize what they are teaching.

The use of field trips is also important to meet engineering club programming and support retention of freshmen who are spending a lot of time in mathematics, science, humanities, and social science courses that are seldom connected well to engineering. The quality of engineering courses is maximized with industrial support through field trips to their work sites.

Career and Networking EXPO. Many companies have always sent recruiters to college campuses. Today, most companies understand that hosting a recruiting event on campus is not free and colleges and schools are looking for additional fund raising opportunities. It is not uncommon for companies to pay \$100-\$500 or more to participate in a college career fair. At The Citadel, there is a college-wide career fair where some engineering companies participate when looking for other than just engineering graduates. The School of Engineering hosts an engineering only focused career fair with 40-50 companies, with companies coming from as far away as Texas and Illinois. A unique focus of the engineering career fair is that it is a mentoring opportunity. All students place their resume on HireLink. During the EXPO, companies are asked to mentor students on what a career in their company could be like which usually includes a discussion of additional educational opportunities. An additional activity that the School provides are locations for companies to interview the students they liked at the career fair. The speed that students are hired and their ability/desire to pass the PE and obtain a master's degree are key for many programs to demonstrate accomplishment of program educational objectives.

Industrial Partnerships Not Usually Cultivated

Research. At large research-focused institutions the research funds come from many locations to include industry, but at teaching focused schools looking to increase their scholarship (research) production, industries provide the best opportunities because the limited number of graduate students (normally no PhD students) severely limits the awarding of research grants from the usual research funding organizations (National Science Foundation, National Health Organization, etc.). The key to increase activities with industry is having a policy that allows faculty to consult each week. At The Citadel, faculty are allowed external employment for up to 8 hours per week as long as there is no conflict of interest and it does not interfere with required faculty duties. This simple policy allows engineering faculty to use their skills to consult through research, analysis, or design. Faculty with PhD's normally look at problems through a different lens which are usually based first on sound engineering principles and not constricted by codes and company policies. Additionally, faculty can bring undergraduate and master's level students to attack problems that many times lead to unique solutions or new procedures. These enhanced faculty skills usually translate into improved course content as well as more students from teaching-focused schools going directly into graduate school, which is a program educational objective for many programs.

Career Center. Career centers need to expand their roles beyond just hosting career fairs to establishing data bases of companies that may or may not attend a career fair. The ability to establish a single contact for human resource offices and a single database containing the timing of company advertises internships/Co-Ops and open full-time positions allows for more efficient communication with students and a better working relationship with companies. Students are very busy completing academic requirements and working part-time or completing military

requirements each week that limits their ability to keep track of these opportunities. A recent example is the lack of applications from our students with a certain aerospace company. Their application window for all openings is the first week of October - before our career fairs and most students thinking about the following summer. To address this challenge, an email is sent to all students communicating application deadlines and minimum requirements. The number of students with aerospace internships has nearly tripled. An internship on a resume with the right company enhances success in the job application process later. The locations and ability to have a job at graduation are key for program distinction which are a measure of the quality of the program.

Student Hiring. The success of student development combined with the success of the career center and departmental activities to advertise for positions has led to 100 percent employed within 2 months of graduation. Most of the delay for these few students not hired by graduation is usually their specific requirements for working location and engineering specialty. Again, a mark of the quality of the program that is not possible without industry contacts interested in hiring the students.

Scholarships. Not all scholarships come through donors (alumni or those enamored with the university), but there are a large number available through industry or societal partners. Some can be designated to the university, but most are open application. The recession depressed many scholarship endowments so increasing the number of students applying for available industry scholarships is important and universities need to increase the number of designated scholarships even if not supported by an endowment. Each renewal period for an industrial designated scholarship is a lot of work, but to support our best students who need financial aid is one of the implied tasks for administrators. A unique aspect to encourage industry partners to support a term scholarship is to add the agreement that the student is an intern the following summer increasing the likelihood of the student being hired. The School of Engineering has developed relationships with societies and companies to provide scholarships at key events such as the E-Week dinner increasing the overall scholarship amount for each program and visibility of the industry partners.

Surplus Equipment. Large research universities are usually able to replace teaching equipment with research equipment as updated research equipment is purchased through new research grants. The decrease in state funding has hit equipment replacement and deferred maintenance the most at The Citadel. So as companies upgrade their production equipment, teaching-focused universities who develop relationships with industry, especially locally, can add excess equipment to their units if the equipment size is appropriate. The enhancements in technology have reduced the size of industry equipment resulting in industry using the same equipment size as the teaching lab. This was not so 20-30 years ago when an industrial lathe would be 4-5 times as the lab lathes today. Many civil engineering firms use similar sized equipment such as geotechnical compaction, concrete cylinder testing machines, survey equipment, and environmental equipment. In other areas, an industrial robotic arm was a great add for a new robotics course; donations by local companies support new labs or the replacement of equipment in labs through naming opportunities; a full scale trebuchet allows for full-scale dynamics

exercises; materials for concrete canoe competition construction; steel shapes for steel bridge competition or welding class, etc. Sponsorships of material or equipment are key to providing quality programs in times of limited state resources and decreased funding from endowments. Even though the economy has been recovering, most states have not raised their state support at all, and not back to pre-recession levels for those states that have raised support.

E-Week Sponsors. Current E-Week activities are supported by Google as a sponsor for the Trebuchet competitions: elementary (build a kit), middle school, high school, college and company (wooden trebuchets), and large company (steel trebuchets). Boeing and other companies provide mentors for the middle and high school wooden trebuchet teams. Local professional societies and companies assist in judging and providing robotics kits for K-12 teams in craft stick bridges and Lego robotics competitions. Without industry support, personnel and financial, the size of the E-Week activities (1500 participants and 3000 total visitors versus previously only 300-500 participants) and the pipeline of new engineers would be depressed and current engineering students would not be working alongside these incredible professionals during these events. Additionally, the number of potential engineering students on campus increased by at least six times which is important for a military and teaching focused university.

Mentors. As part of retention efforts, the School of Engineering hosts freshman, discipline-specific club (ASCE, ASME, IEEE), and special club (SWE, NSBE, SAME) activities where mentoring is a key aspect [8]. These industrial mentors are a direct link to what the future can be. Generally, there is a guest speaker who presents about their company, usually covers the cost of pizza/soda, and then has another 6-9 company personnel at varying career stages to assist in speed mentoring. Similar to the speed dating concept, the students are split into groups and assigned a mentor. The mentor has one minute to introduce themselves, what they do, and then open up to questions. After 7 minutes, a bell is rung and the mentors rotate to another group and the process begins again. Through this type of activity, the students are able to meet 5-6 engineers at varying stages in their career and learn about what it is like to be an engineer in that company or multiple companies. Some of these same people have volunteered to be linked up based on similarities with one to three students to mentor as junior and senior engineers. The School hosts a dinner each semester to ensure the mentors and mentees get a face-to-face meeting while the rest can be email, phone, or face-to-face. The junior and senior mentor program is advertised to freshmen and sophomore students as part of what the future holds (retention). Industrial mentoring is key in student development activities within quality engineering programs.

Local Society Meeting Student Sponsors. Some local sponsors have agreed to sponsor 4-8 students to attend their monthly meetings. This allows the students to hear a guest speaker and be mentored during the meal by those with whom they are seated. Most of the student clubs ensure a majority of the students are freshmen or replaced by sophomores when freshmen are not available to assist in retention. At these meetings professional development hours (PDH) are awarded exposing the students to annual professional engineering development such as annual ethics training. In civil engineering, the program criteria require students to explain basic concepts in project management, business, public policy, and leadership; analyze issues in

professional ethics; and explain the importance of professional licensure. These subjects are the focus areas for many societal presentations and these students bring back these experiences to their own classroom discussions.

Recruiting. Industrial organizations desire to develop their workforce. Some technicians desire to move up to engineering positions while entry level engineers desire to rise to company leadership positions. The Citadel has developed full-time evening programs to support the region with workforce development. Therefore, these companies can encourage their employees through guaranteed promotions and some with cost reimbursement based on grades earned to attend The Citadel's 2+2 program. Students complete the first two years at the local technical college and then complete the last two years at The Citadel when most of the engineering courses are taught. Middle management employees are encouraged to attend the 10-course master's degrees where there are six discipline required courses and then four electives that can be discipline specific, another engineering discipline, business or leadership courses based on what they need to move up in their organization or any combination they need. Additionally, there are 13 graduate certificates (four courses) spread over the four MS degrees that allows the individual and the company both to advertise a skill prior to completion of the entire degree. For example: a student completing a MS in civil engineering could complete 10 civil engineering courses; or the structural certificate, two courses in geotechnical engineering, and four courses in project management or courses in business (accounting, finance) and leadership. Once the structural certificate is completed, the company and the individual could advertise the skill set prior to completion of the other courses in a MS degree. Other students might complete two CE certificates and two project management courses. The key for these master's degrees is a focus on what the student needs to move forward in their company – technical plus other courses.

Adjunct Professors. Academic programs cannot support all courses and programs with full-time faculty, and many rely on 25% of the courses to be taught by adjuncts [9]. These skilled teachers who can provide current practical experience can only be obtained through companies willing to support their employees teaching in the evening and sometimes, when schedules allow, during the day. Some companies understand that their employees' skills grow as they teach a (design) course, but they all know that the students grow immensely when considering all the permits and codes considered during actual design (not always known by faculty). Sometimes the employee needs to depart early to teach or use their lunch break to teach, all approved by the local company. Sometimes the department does not have enough faculty with the right skills when a faculty member departs or suddenly retires. Without industry adjunct professors in the queue, the faculty qualifications might not match the course needing to be taught or the industrial insights will be missing in the development of our future engineers.

Testimonials/Quotes. If an engineering program meets the needs of the local companies, they should be willing to provide employee and administrative testimonials and quotes for marketing material. Sometimes a company does not want to favor one school over another, but will gladly allow their employees who graduated from your school to make these testimonials and quotes. More importantly is these testimonials during ABET visits when the team meets with students, alumni, and industry representatives that are many times active on advisory boards.

Results

Any one of these programs/activities listed above by themselves is not necessarily monumental, but in bulk they become impactful. Many times administrators do not think of all the ways industry partners could/do make a difference within their programs. In the last six years, the activities above have been enhanced or employed with varying success. Sometimes a program or activity must run for a number of years before the rewards are actualized.

With a concerted effort, the School of Engineering has increased the amount and the number of scholarships available for its students. Previously there were about 31 students receiving scholarships to now over 69 receive some type of scholarship.

There were no formal mentoring programs within the School of Engineering, now every junior and senior (72 out of 311) that desire an assigned mentor based on surveyed similarities have one (many have established their own mentors, or the top 40 commanders (18 are engineers) are also assigned a discipline specific mentor through another program). The school even has the local companies increasing their discretionary donations to support the dinners to allow for each semester a face-to-face meeting. These mentoring opportunities also lead to internships that has moved the school to having over 68% of the junior and seniors having an internship. The rest are completing summer school, varsity sports training camps, military training, or working for a non-engineering company.

Our evening 2+2 programs are over 87 percent larger in total (Table 1, 23 percent for CE and 78 percent for EE) with continued discussions on the advantages of the programs for local companies. Many companies are encouraging their technicians to take advantage of our evening programs and move toward becoming an engineer.

Table 1. Evening Undergraduate Enrollments

Degree Type	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
Civil Engineering	26	31	32	32	26	29	32
Electrical Engineering	27	36	46	43	48	48	41
Mechanical Engineering				3	14	18	26

The school of engineering did not have all students with a job or attending graduate school within two months of graduation without the growth in internships, co-ops, and companies attending career fairs and staying afterwards to interview. The School has had five straight years with all students employed within two months of graduation.

Industry boards at all levels were established, but none were focused on fund raising. Now the departmental boards are averaging \$500/member (goal is \$1000/member) per year and the school board is averaging \$2500/member each year. Of course there are large schools where these

amounts appear extremely small. However, based on the necessary transition of board members to create board make-ups that are willing to support and provide their own resources to assist the school, this level of gifts is a good first step along a longer path.

The career center now tracks each student and where they have an internship or are employed after graduation to grow the internship and full employment database to increase the percentage of students that are employed by graduation. The College now has 86% of the students employed or attending graduate school at the time of graduation versus the estimated 65% in 2010.

The School of Engineering is leading The Citadel in publications per faculty member (three times as many as 2010 twice as many as the next closest school). The ability to research with industry, win technical and educational research grants, and consult 8 hours a week as well as the encouragement and overall atmosphere in each engineering department is key to the high production for the team at a teaching focused university. Nearly one-third of the publications are connected to industry-supported research, industry funded projects, capstone projects, and service projects.

One of the most significant barriers to university-industry partnership is a general lack of knowledge from industry and academics alike [10]. It is important to help companies learn about the benefits of partnerships. Others may be interested in the concept of partnership, but unsure how to initiate them. Therefore, Department Heads are tasked with meeting with a new company and attend society meetings each month to support the outreach the Dean is also doing. These contacts by all increase the number of evening (undergraduate and graduate) students in our programs, the mentors available for our students, the available transfer equipment to upgrade laboratories, the number of scholarships (even through term agreements), the number of students attending societal meetings, the number of sponsors/mentors available for needed events and competition teams, the number of consulting/research opportunities for our faculty, the number of available adjuncts, and the number of (dedicated) internships. The desired growth in student population and academic programs (Tables 1 and 2) during the last six years would not be possible without the unprecedented industrial support for The School of Engineering in terms of projects, funding, mentoring, equipment, adjunct faculty, etc. Even the addition of a new engineering program in 2014 (many previous CE and EE students really wanted to be ME if we had it), the industrial support has increased the number of students who want to be CE (total has remained steady from 2011 to 2017. Bump in middle was launching retention programs before launching new programs). EE had the most previous students who wanted to be ME, but wanted to attend The Citadel more.

Table 2. Day Undergraduate Enrollments

Degree Type	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017
Civil Engineering	212	239	255	256	230	223	201
Electrical Engineering	144	166	166	141	125	107	97
Mechanical Engineering				86	170	235	292

Conclusions

Positively moving the needle to locate key resources for student and faculty programs that improve the experiences and skill sets of the students cannot be done without industry partners (Summary in Table 3). The quality and richness of academic programs are directly linked to successful ABET reaccreditation or even initial accreditation for new programs. Industry partners provide technical expertise on required industry boards, owner representation and mentors for capstone projects, real-world capstone project ideas, sponsors for competition teams, internships/Co-Ops, mentors, adjunct professors, etc. which are all critical for the successful operation of all quality programs.

With the current discussion/trend to decrease research funding or at least decrease the overhead available to be charged to grants, all programs will be looking for new resources to support their programs. The late 2018 federal budget has increased research spending, but no one is convinced it is here to stay [4]. The focus of this paper was for a teaching-focused program, but would expect that the research-focused programs are going to need to purposefully expand their industrial connections in the near future for not only accreditation success, but also current operational model success.

Table 3. Industry Partnerships Summary

Industry Partnerships Usually Considered	
Advisory Boards	Industry Executive Committees provide review and approval for ABET accreditation requirements (vision, mission, PEO's, PO's, etc.), curriculum overview based on industry changes, and can be a fund raising arm. Staffed with industry leaders generally hiring current students.
Capstone Projects	Capstone projects are required by ABET. Industry generated capstone projects are usually more real-world and enhance quality of program.
Internships/Co-Ops	Industry sponsored hiring of students usually during the summer, but can be all year based on student course load and company

	requirements. Some companies only hire full time employees from Co-Ops (8 month fulltime internships)
Field Trips	Course or club trips to a construction, manufacturing, or design location to bring to life content in courses (visualization) or programs. Can be used to support retention.
Career Fairs	Centralized location to meet and discuss career opportunities within a company. Some are university-wide and some are discipline (i.e., engineering) only. Most charge a fee to participate to cover overhead and some discretionary support for student programs.
Industrial Partnerships Not Usually Cultivated	
Research	Teaching-focused schools have gifted faculty who can impact local industry through consulting that is research, analysis, or design support.
Career Center	Primary mission is career fairs, resume development, and search engines for internships and fulltime positions. These centers need to be a data center of when companies are advertising, especially those hiring our students.
Student Hiring	Increased industry relationships improve the likelihood of more students being hired at graduation.
Scholarships	Many scholarships are through endowments, but many industry contacts are willing to work with a school or program to support scholarships through term agreements. A unique arrangement is the student being an intern the following summer.
Surplus Equipment	Today more industrial equipment is smaller and similar in size to the lab equipment for teaching-focused programs. Robust industrial relationships increase the likelihood that surplus equipment will be offered to your program first.
E-Week Sponsors	E-week programs cannot grow without financial resources that industry sponsors can provide. Google sponsored a Trebuchet competition that has increased K-16 participation by 6 times. This also brings local students from multiple schools onto campus.
Mentors	Industrial mentors provide the direct link to the rewards at the end of the BS degree that can motivate a student to work through difficulties most experience initially in engineering.

Local Society Meeting Student Sponsors	Students must visualize their future to overcome difficulties. Attending societal meetings can provide the visualization of the group of people they would be working and socializing with, professional development, and mentoring and connections that can lead directly to internships and fulltime employment.
Recruiting	Industrial relationships increase the advertisement of workforce development programs directly increasing student numbers in programs.
Adjunct Professors	Many programs are forced to manage course loads using 25% adjunct faculty. The pool of technically and practice qualified adjunct faculty are working fulltime for the local industry. Long term relationships with companies and one-on-one recruiting are key to gaining access and hiring these incredibly qualified personnel to assist in the teaching load.
Testimonials/Quotes	Student testimonials and company endorsements are critical to the local and regional status of an engineering program.
Equipment Access	Students and faculty may obtain access to specialized equipment (large 3D printers) that the school does not own.

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