

THE EiR PROGRAM AT OHIO NORTHERN UNIVERSITY: PARALLELING THE WORKPLACE ON THE UNIVERSITY CAMPUS

Barry Farbrother¹, Michael Chow², Mark Churpek³, Mike Woodruff⁴,
Tracy Schroeder⁵, Tricia Schroeder⁶

Abstract ^{3/4} The Engineer-in-Residence (EiR) program is a collaborative initiative between the T.J. Smull College of Engineering at Ohio Northern University (ONU), and Marathon Ashland Petroleum LLC (MAP). The program provides an office within the college of engineering from which a practicing professional – the Engineer-in-Residence – operates. The Engineer-in-Residence is an employee of MAP, not ONU. The EiR office space is leased under an annual contract, which includes the provision of some support services. The facility is a scaled-down professional office providing a dedicated office for the EiR, and several engineering cubicles for use by college of engineering undergraduate students. Each station contains a computer workstation, which is linked to the ONU LAN thereby enabling students to gain access to MAP's LAN. Currently MAP has more than fifty projects on which students work under the direction of the EiR. Therefore the program provides students with opportunities to work on real world projects in an environment that parallels the workplace. The agreement also provides a mechanism whereby college of engineering faculty members may invite the EiR to participate in class activities. For up to 15 hours per academic quarter the EiR may be called upon to address workplace-related issues, thereby providing students with a better preparation for professional practice. Example topics include engineering standards, economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political issues. This paper describes the program, includes comment from the Engineer-in-Residence, undergraduates students, and the dean of engineering at Ohio Northern University.

Index Terms ^{3/4} Professional practice, Co-operative education, Experiential work, and Innovative program.

INTRODUCTION

The Engineer-in-Residence (EiR) Program was initiated on September 19th, 2001. It is a unique collaborative effort

between the Thomas Jefferson Smull College of Engineering at Ohio Northern University (ONU), and Marathon Ashland Petroleum Company (MAP). The program provides professional workspace located within the Biggs Engineering building at ONU, which includes an office for the EiR and four engineering cubicles for use by college of engineering students. During its first year of operation MAP provided more than 50 projects to the EiR for engineering students to work on.

The EiR is Mr. Michael Chow, PE, a 1990 electrical engineering graduate of Ohio Northern University. Mr. Chow has worked for the company for 10 years and continues to be a MAP employee. He brings a wide range of company experience to this newly created, independent position.

THE EiR OFFICE

The goal of both ONU and MAP is to bring the professional workplace into the academic environment. The office occupies about 560 square feet of space – an unused, small classroom, designated to become a materials laboratory, but which had not been developed due to funding constraints. ONU made improvements to the facility and MAP provided all the furniture for a fully equipped manager's office and four engineering workstations. The workspace replicates the engineering environment at MAP – professional quality workspaces, Pentium computers, printer, fax machine, etc., all of which were supplied by the company. Access to the office is facilitated by the use of an electronic lock that enables students to work hours that suit their particular schedules. Mr. Chow's normal workweek runs from Tuesday through Saturday, thereby enabling him to be present outside of regularly scheduled academic (M-F) time. These arrangements guarantee students' access to the EiR on a weekly basis. The computer workstations are equipped with MAP standard software and other applications needed for engineering project work. Each is connected via the ONU high speed LAN backbone to the Marathon LAN

¹ Dr. Barry J. Farbrother, Ph. D., C.Eng., Dean, T. J. Smull College of Engineering, Ada, Ohio 45810, USA. b-farbrother@onu.edu

² Mr. Michael Chow, PE, Engineer in Residence, Biggs Engineering building, 525 South Main St, Ada, OH 45810, USA MHChow@MAPLLC.com

³ Mark Churpek, Student Intern, College of Engineering, Ada, OH 45810, USA.

⁴ Mike Woodruff, Student Intern, College of Engineering, Ada, OH 45810, USA.

⁵ Tracey Schroeder, Student Intern, College of Engineering, Ada, OH 45810, USA.

⁶ Tricia Schroeder, Student Intern, College of Engineering, Ada, OH 45810, USA.

thereby providing essentially the same access to corporate resources as are available at the corporate headquarters located in Findlay, OH.

COMMENTS FROM THE ENGINEER-IN-RESIDENCE

The EiR program developed by MAP and ONU adds a new facet to the college of engineering's programs. The EiR program brings the co-op experience to the University campus. A traditional co-op program usually requires students to take time off from their college education to work at a company's facility. MAP has co-op students working in both the traditional and EiR programs.

There are some differences between the traditional co-op program and the EiR program. The EiR co-op students are challenged by the additional task of taking classes full-time while working part-time. These students need good time-management skills in order to be successful at both their studies and their work. In a traditional co-op program, the student is not taking classes and is a full-time worker.

Another difference between these programs is that students in the EiR program are scheduled to graduate in four years. In a traditional co-op program, the students typically take five years to graduate due to the time spent away from college. The EiR program targets those students who normally would not participate in the traditional co-op program, but desire engineering work experience.

The EiR program is a win-win-win situation. The University benefits from its strong tie to a regional and national leader in the industry. The union helps support ONU's engineering accreditation status. The EiR program also provides the University with a strong student recruitment tool.

The co-op students in the EiR program help MAP complete engineering projects, which provide value added service to the company and its business partners. Most of the projects are design-related and having the EiR office in the University's engineering building is an advantage.

The EiR program provides MAP an additional recruiting resource. The EiR program allows MAP to recruit students who normally would not partake in the traditional co-op program. With the opportunity to evaluate the students in the EiR program, MAP has a broader method to appraise a student before he or she receives a full-time job offer.

The students win by gaining valuable engineering work experience working on diverse projects. The students also receive a salary, and they learn how to manage their schoolwork, social life, and work schedule. The challenges of working in the office have not been a detriment to their

studies. All the students made the Dean's List the first quarter the office opened.

The EiR serves as the on-site mentor and supervisor for the co-op students. He shares his engineering experience with the students and provides guidance with their projects. There are individual meetings once a week to go over each project. The students meet collectively once a week to discuss projects and issues. The EiR also participates in classroom discussions.

Having the EiR speak about engineering topics in the classrooms has, and will continue to help, both the students and the company. These discussions involve workplace issues and include case studies, helping students to understand how engineers rely on teamwork in the modern engineering environment, discussing design-related issues, and discussing topics such as the need for engineering standards, communications skills, professional ethics, etc.

The discussions provide an avenue to share ideas between industry and educators. The University can adjust its curriculum to better prepare their students for dealing with workplace issues. The company gains knowledge of the skills a graduating engineer will possess and can tailor his or her training appropriately.

MAP is very pleased with the EiR program, which allows the company to tap into a resource of engineering talent and offer students relevant work experience while on campus. The response from ONU's faculty, the co-op students, and MAP to the EiR program has been tremendous.

COMMENTS FROM THE STUDENTS

An opportunity is provided here for four of the present EiR program students to share their experiences.

Mark Churpek: Senior - Civil Engineering

The Engineer-in-Residence (EiR) program at ONU has provided me with an excellent tool in providing a parallel between the curriculum taught in the classroom and real world engineering problems. The work I perform while working at the ONU/MAP EiR office demands that I use not only the skills specific to my discipline, but also tests my abilities to use the engineering approach to examining problems.

Several of the projects I have worked on I have been able to directly relate to class work. I have even made use of textbooks that I have kept from use in previous years for projects on which I am currently working. Because the MAP office is located within the College of Engineering building, this has also enabled me to use the faculty as a

resource. They can offer advice on a problem I have or just give a suggestion to help get me on the right track.

Recently, one of the assignments I have been asked to perform was to propose a specification for using fibers as concrete reinforcement. Because this was a subject about which I previously had little knowledge, I turned to a structural engineering professor for advice. The professor had completed his PhD in this area and was able to lead me in the right direction in my research. I also have been working on reviewing calculations for ID signs for use at convenience stores.

Looking at the foundations of these signs at first appeared to be the most difficult challenge. Conveniently, however, I am actually taking courses in soil mechanics and foundations this quarter. The research I have done outside of class and the knowledge I have gained while in class has made both the work at MAP and the schoolwork for my foundations class more productive.

On several occasions I have been asked to do work or research that I was not familiar with at the time, but that I would be learning later in my studies. This process of learning something in order to perform the work has, in turn, benefited my learning process in the classroom. This has aided in my ability to comprehend and find the important aspects of what I am reading. It has not only increased the understanding of the new material but has also aided efficiency of length of time I spend to find out what I really need to know. The necessity of finding books and materials needed to perform this work has also given me knowledge of valuable resources that I can use for other class projects outside of the MAP office.

Outside of the knowledge I have from working at MAP that I can use in school and vice versa, there are other benefits that have improved various skills that I can use everyday. The tool that has been most tested has been my ability to manage time. The addition of approximately fifteen hours a week working in the MAP office alone has tested my abilities to juggle schoolwork, projects, and extra-curricular activities. This added pressure however has made me perform all of these tasks not only at previous levels but has driven me to exceed beyond prior expectations.

Overall this experience has been very rewarding and I can see the benefits this will have on my future professional career already. I would highly recommend a program like this to anyone looking to challenge him or herself and get a close look at how the class work parallels the real world.

Mike Woodruff: Senior – Electrical Engineering

I have enjoyed the opportunity to participate in the Engineer-in-Residence program. This has allowed me to gain valuable

experience in the working field while going to school full time. I have worked on several interesting projects. I have not used my class knowledge extensively, although the overall study skills from my education have helped me greatly.

One important skill I have enhanced through the EiR program is time management. Attending school full time and handling several projects at once is quite a challenge. Good time management skills have helped me maintain a good standing in my education, helped me to complete my projects by their deadlines and still have some time to enjoy my hobbies. Time management skills have always been an important aspect of my college life, which is one thing I have developed while attending college.

The projects I have worked on involve electrical engineering: recommending an Uninterrupted Power Supply (UPS) and comparing different vendors' circuit breakers. These projects required the evaluation of current technology being used and the recommendation of future technology. They required general research and the investigation of the characteristics of these devices. All of the specifications are important when evaluating and recommending one supplier over another. The specifications are critical because each device is specifically made for certain types of application. Therefore, one must clearly understand the purpose where the product will be used, and how it is going to be used.

Another project I am currently working on deals with lighting issues and a Programmable Logic Controller (PLC). The PLC controls the exterior lighting at MAP's convenience stores. I have been working on a solution to safely and easily turn off the lights at the non-24 hour stores. This has been the most interesting project I've worked on so far. Even although I have not used PLCs before, it has given me the chance to learn something new, such as programming with ladder logic, while working on a solution for a project. This has given me a chance to apply some hands-on work and actually simulate the solution I have generated.

The EiR program has been a great learning opportunity and has also given me the opportunity to gain valuable experience in the work field. Though this has been a challenge, it has forced me to improve my time management skills. This will be a great benefit when I enter the work force and must handle several projects at once. This has been a great chance for me to begin exploring what the engineering world is all about. I now know that I may or may not use all my electrical engineering knowledge in the work place however, I understand that the work skills I have developed in the EiR program and in school will help me learn and be successful at any job.

Tracy Schroeder: Junior - Mechanical Engineering

I am currently enrolled in a class called Engineering Analysis in which each student is required to individually solve an engineering case study each week. These case studies utilize skills acquired and perfected in other engineering classes. Just last week, the problem assigned was to find how much a manufacturer could afford to pay for one centrifugal blower, which had a higher efficiency as well as a higher installation cost, than a second centrifugal blower, assuming a reasonable payback period. For this assignment, I referred to lessons in engineering economics learned in a Numerical Methods class last quarter. Also, just this week, in my Thermodynamics class, the professor provided us with a real life example of a heat transfer problem involving an asphalt-heating tank. This tank was heated by steam coils and was losing heat energy to the surrounding air and ground. The concept of mineral deposits building up on the coils was offered as a possible solution to slow heating problems.

I also work in the Engineer-in-Residence program where I gain valuable experience while earning my undergraduate degree. In the same week that the blower case study was assigned, I was given an assignment at work to calculate a break-even point for money speculatively spent on two types of HVAC (Heating, Ventilating, and Air Conditioning) systems with differing efficiencies and installation costs. I am also working on researching an asphalt production terminal's hot oil heating system for potential problems, most likely related to mineral deposits on the heating coils in the tanks.

These are only two of several examples of how classroom studies have related to work assignments since I commenced work in October 2001. In the classroom, I've also been taught the importance of persistence, precision, keeping up with changing technology, finding needed information quickly, and being a supportive and active team member. I have found each of these lessons to be essential factors of a positive work performance.

The Engineer-In-Residence program is a great opportunity for MAP to evaluate potential long-term employees and gives students a chance to test out their engineering skills while gaining work experience. Trying to concentrate on school and work simultaneously can be difficult, but I think the result is increased enthusiasm and focus in each area. Looking toward the future, I expect continued satisfaction and value from the EiR program at Ohio Northern University.

Tricia Schroeder: Junior – Mechanical Engineering

As a junior at Ohio Northern University, I have been given the unique opportunity to be a part of the Engineer-in-

Residence initiative. As a participant in this program, I work an average of 15 hours each week for MAP while attending school full time in pursuit of a bachelor's degree in mechanical engineering. At MAP, I am assigned engineering projects pertaining to my field of study, and I work in a room on campus, inside the Biggs Engineering building, which closely simulates actual MAP office space. The opportunities and advantages for students in this program are exceptional.

For example, I am given experience in projects that allow me to gain exposure to the field of mechanical engineering. Perhaps the leading benefit from this type of program is the opportunity I have to apply classroom knowledge as it is learned. Last quarter, in the classroom, I learned various methods for gathering engineering information, such as how to find manufacturers of specific products in the United States. These specifics became immediately useful as I was assigned to select the most economically sized water heater for the Speedway SuperAmerica LLC convenience stores. Another one of my projects at MAP involved comparing insulation types to find the most cost-effective system. For this project, several abilities learned in the classroom were utilized, such as calculating R-values, finding and compiling various insulation options, and comparing insulation properties.

Also, in several classes I have learned teamwork skills and tools. As they would have in any job, these also became immediately applicable in communicating with co-workers inside and outside of the immediate Ohio Northern EiR office. Another valuable outcome is the opportunity for students in the program to improve time management skills. I am involved in school activities including the American Society of Mechanical Engineers, the Society of Women Engineers, and Tau Beta Pi, as well as activities outside of school, such as playing the piano at church on Sundays. Keeping a reasonable balance between work, school, and other activities can sometimes be a challenge.

Of course, my long-term goal through this experience is to learn MAP's standards, initiatives, and current practices, and to hopefully use this information to pursue a career with MAP after graduation next year. The collaboration between Marathon Ashland Petroleum and Ohio Northern University has provided me with these new opportunities.

COMMENTS FROM THE DEAN OF ENGINEERING

This initiative has exceeded my most optimistic expectations! Prior to joining ONU I had experienced a similar program but wanted to improve on that experience by making the engineer much more visible to undergraduates. Certainly Mr. Chow has done an excellent job of mentoring the students in the program who have

worked in excess of 1600 hours, completing more than 40 projects.

There are several benefits, which accrue to the college of engineering. Firstly, the presence of the EiR makes it possible to have a practicing professional engineer discuss work-related issues in the classroom. Written into to EiR contract with MAP is a clause that provides for classroom presentations. Engineering faculty members may invite Mr. Chow to class for a variety of purposes – perhaps to present a case study, or to lead a discussion on contemporary issues such as those relating to “economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political” issues. Readers familiar with the requirements of the Accreditation Board for Engineering and Technology (ABET’s) Criteria 2000 will recognize the specific wording!

From the student perspective the opportunity to undertake “real” engineering project work for an external client has provided them with an outstanding preparation for professional practice. They have certainly had to learn how to manage their time because the engineering degree programs at ONU all exceed 200 quarter-credit hours. Those students who participated in the program in this inaugural year have completed their bachelor’s degree requirements in addition to a co-operative education program, in four years, without having to leave campus.

The university has enhanced its relationship with an employer of its engineering graduates and been able to use the program as an example of innovation within the college of engineering. The financial income derived from the EiR lease, although not a huge sum does represent additional income that has been generated from a previously unused space within the engineering building. This income can be used to support the academic programs within the college, or simply to help contain the increasing costs associated with engineering programs. In addition, the remuneration received by students has enabled them to continue their studies while providing resources to pay for the rather high cost associated with private education in the USA.

THE FUTURE

The college has received inquiries from other entities interested in participating in the EiR program. Certainly, from the college perspective, there is a desire to make accessible to ONU students, professional engineers with a variety of expertise and experience in order to provide the very best exposure to the professional workplace and associated issues. Two potential partners for the program have indicated their desire to partner with the university, and the college will be moving forward to see how this may be accomplished.

The potential exists to further enhance this concept to develop an Entrepreneur in Residence program. The college is very interested in encouraging its graduates to consider careers in consulting and other business areas in which they would start and build their own organizations. Possibly there may be no better environment for entrepreneurial activity than the USA, which has a strong entrepreneurial mindset supported by available venture capital along with a “can do” or “American dream” mindset! The present teenage generation is certainly aware that careers in engineering and computer science can provide them with the skills to enable them to become the CEO of their own company. Notwithstanding the rapid rise and demise of the .com community, they appear willing to seek careers with organizations other than large corporations that have traditionally been the proving grounds for large numbers of graduating engineers.

From the entrepreneur’s perspective, the availability of quality space within an engineering environment provides considerable appeal. The availability of high quality workspace along with resident engineering expertise enables the entrepreneur to devote his/her intellectual effort to product development. If financial issues (particularly cash flow) are an issue, agreements can be developed which provide for compensation to flow to the college or university, at some future date. Bringing the entrepreneurial mindset into the academic environment is not a new concept, a fact that is attested to by the number of technology parks and other for-profit entities that have been created by universities in recent years. What is new is to be able to provide access to the entrepreneur for undergraduate students. It is totally appropriate therefore, to provide engineering programs that equip the next generation of engineering graduates with necessary business skills in addition to their engineering toolset. They need also to have the mindset that will enable them to merge their problem solving skills with business and management skills, so that they become contributors to the economy through job and wealth creation.