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Sabbatical Leaves with Industry—Three Experiences

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Bob has published over 140 articles, chapters in textbooks, and technical reports, many in the area of process planning and improvement, and has been an invited speaker or panelist at numerous technical symposia. He is co-author of the textbook *Applied Integer Programming*, published by Wiley in 2010.

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Sabbatical Leaves with Industry: Three Experiences

Introduction

One approach to developing and strengthening relationships between universities and industry is to have tenured faculty members engage in one-to-two semester sabbatical leaves at an industry site. Personal relationships between the faculty member and managers/engineers at the host site are developed; graduate students can become involved in a way that leads to a masters or doctoral degree research topic; follow-on contracts and publishable results often benefit the faculty visitor; new methods/technology introduced by the faculty visitor, and introductions to other faculty members with specific expertise, can benefit the industrial host.

In contrast, most sabbatical leaves involve leaves of absence for an extended visit to another academic institution or a government laboratory. The intent is often to collaborate with a host researcher or team, to utilize specialized facilities, or perhaps to develop a new research interest. If the visit is funded, it is usually a grant and the researcher has extensive latitude in what activities to pursue. Publication of research is a secondary goal, and involvement of graduate students is generally not considered. In an early section of this paper, we discuss the history and purposes of sabbatical leaves.

The author participated in three sabbatical leaves with industry during the 21 years 1990-2010: the first two for an entire academic year (9 months) with half salary and half benefits paid by the company, and half paid by the university; the third leave for one semester was with an industry member group, fully paid for by the university. In all three leaves, travel and housing expenses were *not* included because the location of the sabbatical leave site was within one-hour commuting distance of campus. In general, plans for sabbatical leaves must be made 1.5-2 years in advance, and a critical part of planning is obtaining funding for the second semester (if one is planned) and for travel and living expenses, and anticipating impacts on colleagues and the family. The main objectives of each of three sabbatical leaves with industry will be discussed. These objectives included: instruction of managers and engineers in areas of faculty expertise; coordinating and facilitating improvement teams; involving several master of science (MS) students in non-thesis research projects at the site; learning new areas through reading, observing, and participating in teams and committees; and preparing course materials in these areas. A number of positive results from each leave were obtained and will be discussed briefly. Finally, a summary and conclusions section with recommendations is provided.

History and Purpose of Sabbatical Leaves

Sabatini¹ reports “The concept of a sabbatical dates back to the Old Testament, which instructs Jews that every seventh year their fields should be left untilled. More recently, an academic sabbatical is generally defined as a year of study or travel, usually every seventh year. In both cases, a sabbatical year is intended to be a time of renewal and rejuvenation.” According to Eells², the first definite system of sabbatical leave was established in 1880 at Harvard University. At least ten institutions had sabbatical leave plans by 1900, and 40 additional institutions by 1920. Today, every U.S. university is expected to have a sabbatical leave policy which invites tenured faculty with an interest in a sabbatical project to develop and submit a comprehensive plan, which is reviewed by administrators and though not automatic, is often approved. Eells² concludes that “sabbatical leave thus involves *three essential elements*: purpose, compensation,

and a definite period of prior service in the institution.” We shall discuss each of these elements in turn.

Purpose: Bennett and Krueger³ claim “sabbatical leaves for faculty are important (to the individual) because they serve to promote their professional development by providing opportunities for reflection, artistic creation, research, innovation in teaching, and professional exploration.” Sabbatical leaves with industry for engineering faculty, from the point of view of the institution, is a form of personnel exchange. ASEE⁴ has taken a position that “time spent by engineering faculty and graduate students in industry can enhance transfer of new technologies to industry, as well as provide practical experience and an understanding of business policies. Each engineering college should develop reciprocal personnel exchange programs with local and regional corporations... These partnerships must also focus on the real needs of both corporate and university participants, and feature a variety of exchange modes, including industrial professorships and university sabbaticals in industry.” So, sabbatical leaves for engineering faculty in industry can be the starting point, or a natural result, of an institution partnering with industry. Guide and Van Wassenhove⁵, though business professors, identify some purposes served by sabbaticals with industry:

- Encourages exploration of unexplored research territory that is of vital importance to industry
- Working with industry provides unlimited opportunities to explore firsthand uncharted research territories and (hopefully) implement ideas in the real world
- Working with industry brings real-life relevance to our research and confidence that what we are teaching is useful and practical.

Compensation: Generally, the sabbatical is taken for one semester with full pay, or two semesters with half pay, provided by the university. Insurance and other fringe benefits continue under the one semester plan. The two semester sabbatical requires external funding for half of the sabbatical salary, and half of the cost of benefits. Such funding can come from a number of sources, including the host university, the government or industrial host, a foundation, endowment, or other sources. Such funding may require the visitor to teach a course, participate in research and development, or use some other special skills or experience in service to the host organization. If travel and living expenses must be paid, then the visitor has to apply for grants from government agencies or perhaps the home institution, use an overhead account he/she controls, or simply pay these expenses out of the sabbatical salary.

Period of Prior Service: Most institutions permit a faculty member to apply for sabbatical leave after seven years of continuous service, with a promise that if the leave is granted, the recipient must return to the institution for at least one year after the end of the sabbatical leave. The timing of a sabbatical depends on at least three factors: (1) The situation in the applicant’s department, college, and university (staffing, and the institution’s emphasis on curriculum revision, new course development, and/or externally funded research); The availability of a site willing to host the faculty member, and perhaps provide funding for parts of the expenses of the sabbatical; (3) Career factors of the applicant. Such factors might include:

- A shift in career emphasis
- A research need (concentrated time, lab time or equipment access, collaboration, etc.)
- Time for learning a new topic or technique, for teaching or research purposes
- Time to prepare for and develop new course materials.

As Bennett and Krueger³ state “The decision on if and when to take a sabbatical leave is a personal one and involves decisions that reflects a faculty member’s research, teaching, and career objectives.” Of course, objectives should be viewed as beneficial to the institution as well.

Three Sabbatical Leaves with Industry 1990-2010

The intent to this section to describe the type and size of the three organizations the author visited for sabbatical leaves over a 21 year period, and the purpose of each sabbatical as described to his department, college, and university administrators. Before we proceed, a key question is *how does one develop contacts with industry* in order to even propose a sabbatical leave at that site, much less ask that the industrial partner pay half the salary and benefits of the faculty member for nine months? Developing contacts with industry can occur in various ways, such as:

- Openings with former students, or university alumni in general
- Introductions from a colleague, such as a senior faculty member or a center director
- Meeting senior engineers and managers through professional society activities
- Publishing in journals read by senior engineer and managers in the particular industry
- Meeting members of departmental or college industrial advisory boards.

You may have to prove your worth in a small-scale project before the company would consider taking you on as a sabbatical leave guest. After you make the contact and help provide a solution of worth (you have to perform!), you will have established a reputation with the company which may lead to a larger-scale project, new projects with other managers, or acceptance of your sabbatical leave proposal. In the three sabbatical leaves described below, the first began with a UA center director introduction, then a small-scale project. After a second, larger-scale project, the company accepted my proposal for a nine-month sabbatical, with them paying half my salary and benefits. In the second sabbatical, I had the Vice-President of Engineering and Quality in one of my MS-level courses; eventually, he did his non-thesis research under me and provided the entre for my nine-month sabbatical at his company. In the third sabbatical (one semester only), I wanted to develop a new safety engineering course for civil and construction engineers. I had met the president of a construction industry member group who served on our industrial advisory board. Once I found out this group had a members’ Safety Committee and an OSHA/MSHA library on-site, I knew this would be an ideal location to carry out my objectives.

Sabbatical #1: American Cast Iron Pipe Company (ACIPCO), AY 1990-91. This company, located in Birmingham, Alabama, was founded in 1905 by industrialist John J. Eagan, who left the company as a perpetual trust through profit-sharing for its employees. Known throughout the world as a leading centrifugal casting manufacturer of ductile iron pipe, the company also manufactures grey iron fittings for its pipes, a line of steel tubing—some of which is machined into the molds for the various size pipes that are cast, and a variety of welded steel pipe to the American Petroleum Institute (API) standards. On top of that, the company is a huge recycler of scrap automobile bodies (which are shredded and the metals melted down in a cupola that runs 24-7 year-round) and boasts one of the most well-equipped laboratories in the iron and steel industry. As of 2010, the company employed 3,000, had annual revenue of \$1.2 Billion, and has been recognized in “The 100 Best Companies to work for in America.” Engineers play a huge role in this company, from design of products and manufacturing equipment, to process

engineers in the various shops. Many shop superintendents worked their way up through engineering responsibilities in that shop.

I was introduced to this company as a new associate professor by the University of Alabama (UA) Director of the Metal Casting Technology Center, and given a small funded project to try to reduce defects in a small, green-sand foundry that cast brass components for fire hydrants and hoses. Once my students and I succeeded there, we were given a more demanding project related to defect reduction in one of the ductile iron pipe shops. I also developed a basic understanding of the ACIPCO corporate culture and production processes. After that, the Vice-President of Operations (Works Manager) was willing to fund a UA contract for half of my sabbatical year salary and benefits, with the objective of starting a company-wide continuous improvement activity. My objectives for the sabbatical were: to advance my knowledge of the iron and steel industry, to add to my knowledge of the writings of W. Edwards Deming, Joseph M. Juran, and other quality thought leaders, and to attempt real-life applications of the theories of statistical quality control, correlation and regression analysis, and robust product and process design I had been teaching for several years. I took on the role of Acting Quality Improvement Coordinator, and in this role for nine months accomplished the following:

- Taught the upper and middle managers throughout the company a course on Quality Leadership, based on textbooks written by W. Edwards Deming and J.M. Juran. Though I had read some articles on these two “quality gurus”, this was the first time I studied their writings and background in depth, and of course the students—being managers with 15-30 years experience in a successful company—challenged my explanations at every turn.
- Taught the technical professionals (engineers, material scientists, laboratory personnel, purchasing agents, safety and ergonomics professionals, sales engineers, etc.) courses on Statistical Quality Control and the Taguchi Method of robust product and process design. I had been teaching SQC as a 400/500-level elective at UA since 1986, but this was the first time I got to teach these methods and techniques to technical professionals (a much more challenging student body).
- Identified and documented over 200 potential improvement projects from my course attendees, and served as facilitator and statistical consultant to each of twenty teams that completed their work in that first year of ACIPCO’s quality improvement initiative. Projects were engaged in all aspects of the company’s operations, from human resources and purchasing of materials through all production areas, eventually getting into maintenance and after-sales service.
- Involved several graduate research assistants in my follow-on contracts with ACIPCO, some of which became their MSIE non-thesis research project.
- Brought in colleagues from my UA Department, with expertise in work-place ergonomics and statistical analysis of large data sets, to do UA contract work with ACIPCO.
- Helped train my replacement, the first permanent Quality Improvement Coordinator—a position that still exists today, over twenty years since I stopped working with ACIPCO.

Sabbatical #2: Mercedes-Benz U.S. International (MBUSI), AY 1999-2000. This company, part of the famous Daimler-Benz AG Corporation of Germany, was the first US automotive assembly plant for Daimler, the first plant in the corporation to employ the lean manufacturing practices made famous in the Toyota Production System, and began production at a green-field site in Tuscaloosa County, Alabama in 1997 producing one of the first luxury SUVs, the M-Class. So, MBUSI was the testing ground for the Mercedes Production System, building a newly-designed

German vehicle in the Deep South using an assembly workforce with little or no prior automotive experience. Many UA faculty members in business and engineering were intrigued. However, the management team came from highly respected OEMs such as Toyota, Nissan, and Honda. One of those managers (started as Director of Quality when plant was announced in 1993, promoted to VP of Engineering and Quality by the time I had him in a graduate class) turned out to be the contact that got me the funding for my second two-semester sabbatical. This sabbatical coincided with my stepping down after five years as Head of Industrial Engineering at UA, and was intended to provide research momentum for me, and time to think about how to structure a new course in supply chain logistics or quality. My objective for this sabbatical was: To perform both basic and applied research in the topic of “quality of assembly” by literature search, reading and writing, while working one-half time in the Quality Engineering group at MBUSI. More specifically, project goals were: To become thoroughly immersed in the problem of planning for and assuring quality of mechanical assembly; to become familiar with the specific problems and approaches used in lean automobile assembly; to build a stronger relationship between the UA College of Engineering and MBUSI.

The first month of my sabbatical, I spent a lot of time reading about lean assembly and then taking guided tours of the various assembly lines to view plant-specific implementations. I was also given access to the entire data base of defective supplied parts from approximately 100 first tier suppliers, and asked to use my statistics background to uncover information that might be useful in reducing the defect percentages for certain parts, and for suppliers overall. I did some detailed investigations on surface defects in interior door panels, most of which were related to material handling at the supplier or during transport and handling to get them to the MBUSI door assembly line. As I prepared a report of my findings, the MBUSI president decided for that model year (1999), he would have a special focus on supplier improvement, and I was named Acting Supplier Improvement Coordinator under the Director of Quality. This activity consumed a great deal of my time, but also provided opportunities to see lean manufacturing and assembly processes at suppliers, and built my understanding of the modern automotive supply chain, which often spans multiple states or even countries. Once again, I was facilitating multiple improvement teams, but with the twist that these teams were cross-company, with members who were representatives from MBUSI (product engineering, production, quality, purchasing, and logistics) and representatives from the supplier of the problematic part. With the upper management at both supplier and OEM behind the effort, the teams were able to make significant reductions in quality problems in the matter of 2-3 months, as documented in Batson⁶.

When I was hosted by MBUSI, there were roughly 1,500 employees, and I wore the uniform, had a security badge, had a desk in the engineering group, and was treated like any other employee. After 15 years, employee headcount has doubled to 3,000 with three more Mercedes models under manufacture, including the popular C-class sedan. Today, MBUSI is responsible for more than 22,000 direct and indirect jobs in the region, and has an annual economic impact of more than \$1.5 billion. MBUSI is also the state’s largest exporter, with more than \$1 billion in exports each year to countries throughout the world.

Sabbatical #3: Associated Builders and Contractors-Alabama (ABC-Alabama), Fall 2010. This is the state office of a national construction industry member group, whose members support merit (non-union) shops for craftsmen. ABC-Alabama has offices and meeting space in a suburb of Birmingham—Homewood, Alabama. This small office with six full-time employees exists to serve the needs of its member corporations, from large design-build constructors with hundreds

of employees down to the smaller, specialty subcontractors. The ABC-Alabama President served on the industrial advisory board for UA BS in Construction Engineering (BSConE) degree program. After meeting him and learning the role of ABC-Alabama in the state's construction community, the fact that ABC maintains an extensive and up-to-date library of OSHA and MSHA materials on-site, and that ABC has a Safety Committee made up of safety directors from its members, I decided that this environment would be ideal for me to research and develop course materials to revamp CE 464/564 Safety Engineering, a required course for the BSConE and an elective popular with our BSCEs. Not only were printed and video materials literally in the library next door to my assigned office, but I was able to take site tours with safety officers from local corporations and obtain honest reviews of my course outlines and draft materials from the Safety Committee, in whose monthly meetings I was an active participant.

The purpose of the ABC sabbatical was: To become more familiar with the construction industry, with all OSHA regulations that apply to construction, and with construction safety practices in a typical construction firm, in order to prepare myself to take over CE 464/564 Safety Engineering, direct master's thesis research in safety engineering, and write comprehensive proposals for research contract and grants in areas related to construction safety and productivity. In preparation for this sabbatical, I took two courses at Georgia Tech's OSHA Training Center: OTI 510 Occupational Safety and Health Standards for the Construction Industry; OTI 500 Trainer Course in Occupational Safety and Health Standards for the Construction Industry. During the sabbatical, I was expected to interact with the ABC-Alabama professional staff and their member safety managers/engineers at corporate offices and construction sites. Multiple site visits were taken as day trips around central Alabama, escorted by the constructor's Safety Director and site Safety Engineer. Direct observations and their responses to my questions were valuable in preparing course materials and in my ability to speak with confidence when describing corporate practices to my students. As mentioned, I had the objective to develop an entire set of PowerPoint slides and background materials for CE 464/564, which I completed. Finally, I was expected to prepare and submit a Susan Harwood Training Grant proposal to OSHA HQ by mid-December, 2010, which I accomplished but was unsuccessful in getting funding for the topic "Ergonomic Hazards in Masonry Construction," though I did produce a refereed publication⁷ of that title for the journal Professional Safety.

Results of Sabbaticals

Collectively, the career-enhancing results of the three sabbatical leaves described above were satisfying to me as well as to the administrators who approved the leaves and had expectations that were met in the numbers I produced:

- Funded university contacts with companies:
 - ACIPCO: \$55,219 for 9-month sabbatical half-support, with four follow-on contracts for a total of \$57,602
 - MSUSI: \$55,948 for 9-month sabbatical half-support, with two follow-on contracts for a total of \$78,793.
- Courses developed after sabbatical ended:
 - ACIPCO: IE 522 Quality Engineering (Taguchi Robust Design Methods) taught 12 times, 1989-2003; Quality Leadership taught in UA Continuing Education, 7 times 1993-96; Statistical Methods for Quality Improvement, taught in UA Continuing Education, 5 times 1993-2003.

- MBUSI: IE 470/570 Supply Chain Modeling taught three times 2005-07
- ABC-Alabama: CE 464/564 Safety Engineering taught three times 2012-2014.
- Refereed Publications directly related to sabbaticals:
 - ACIPCO: Seven, most in proceedings and handbooks
 - MBUSI: Nine, split evenly among journals and proceedings
 - ABC-Alabama: Two, one journal and one proceedings
- MS Non-thesis Research Project Reports:
 - ACIPCO: Two students
 - MBUSI: Three students
- New lines of research:
 - ACIPCO: Use of correlation and regression analysis to screen for causes of defects found in castings, and in continuous steel welds.
 - MBUSI: Quality improvement investigations in multi-step manufacturing supply chains; Cross-company supplier improvement teams; Supplier management.
 - ABC-Alabama: Ergonomic hazards in masonry construction; Design for safety of the constructor (part of Prevention through Design).

Summary and Conclusions

The history and purpose of sabbatical leaves for university faculty members was reviewed. Three sabbatical leaves taken by the author with industry (one in the iron and steel industry, one with an automotive OEM, and one with a state construction industry member organization) were discussed, with overall results as follows:

- Funded contracts worth \$246,000 with the two industrial companies split almost evenly between the sabbatical leave contract and follow-on contracts.
- Courses developed after sabbatical ended, for example graduate-level courses in quality engineering, supply chain modeling, and safety engineering.
- Eighteen refereed publications related to the sabbaticals, split almost evenly between journal and proceedings articles.
- Five MS Non-thesis Research Project Reports (in lieu of master's thesis).
- At least two new lines of research from each sabbatical leave.
- Three faculty colleagues were introduced to and funded by one of the sabbatical leave hosts.
- Contacts at the three organizations to meet various university needs: Contacts for co-op, intern, and permanent job opportunities; contacts for senior design projects with industry; contacts for guest speakers to class or student society meetings.

All three sabbatical sites were within one-hour commuting distance of my home in Tuscaloosa. *What if the sabbatical site was more distant?* I can describe from summer experiences what I would have done in case driving distance was: 1) too far for daily commute, say 3-6 hours, but could be considered for weekend trips to/from home; 2) was longer, perhaps 6-12 hours from home. In Case 1, this is very much like NASA Summer Faculty Fellowships I held four summers in Huntsville, Alabama, which is a three-hour drive from Tuscaloosa on interstate highways. For ten weeks over the summer, I would drive up early Monday morning and return home late Friday evening, spending Monday-Thursday in an inexpensive hotel in Huntsville, and Friday-Sunday at home. Sometimes I paid the travel and living expense out of my stipend; other times I used research overhead I had earned and controlled, to reimburse my travel expenses. I never asked

the institution to support my travel, but I could have if I did not have the overhead account. Such might be the case for a new assistant professor, but not for someone who achieved tenure and by definition, held research contract and grants that brought in overhead. In Case 2, I would recommend moving into a low cost hotel on a weekly or monthly basis at the sabbatical location, with return home monthly rather than weekly. These monthly trips could get expensive if airfare was required, so I would recommend selecting a corporate site with distance from campus within a one day's drive (12 hours), with the use of airlines only in emergency.

One conclusion based on these three experiences is that in general, the host company/institution must see some benefit in the sabbatical leave experience, in order for a contract to be awarded; however, for a one-semester university-funded visit, there is little or no expectation that the faculty visitor will actively participate in the work of the organization. Also, the payoff in terms of funding, course development, publications, involvement of student and faculty colleagues, and enhanced industry-university partnerships can be satisfying to both the faculty member and his administrators. Such payoffs are fully described in the paper. The recommendation is to consider sabbaticals with industry in order to provide a boost to one's career at important intervals, as documented here.

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