

**The Role and Scope of Engineering Consulting in a
Balanced and Integrated Career and Personal/Family Life
of a New Engineering Educator**

by Dr. Robert Engelken, Professor of Electrical Engineering

**Arkansas State University
P.O. Box 1740
State University, AR 72467
(870) 972-3421
(870) 972-3948 (FAX)
bdengens@navajo.astate.edu**

I. Abstract/Introduction

This paper will explore how engineering consulting fits into the role and scope of a new engineering professor's career and his/her pursuit of "academic wealth" [1, 2, 3]. Consulting is defined as offering one's professional services to external clientele for a fee or other reward, usually independent of one's standard university salary [4]. Although a fundamental part of engineering, consulting for engineering professors can be an ill-defined and controversial matter within the framework of employment, time, public relations, and intellectual property policies of a university and whether a particular university actively encourages and supports, passively allows, discourages, or prohibits such activities.

Consulting offers many benefits for a new engineering professor and, indirectly, for the university, community, and profession. It builds a contact network that can be invaluable for other purposes, such as research, public relations, fund raising, and outside expertise. It provides the new faculty member a "real world" vs. "ivory tower" perspective of the profession. It provides ongoing continuing education through having to learn, often quickly, new knowledge and skills for nearly every new and often unique consulting opportunity; this can be valuable in the pursuit or maintaining of professional engineering (PE) registration. It provides experience in planning, budgeting, record keeping, billing, collection, human relations, and communications that often is quite different from that provided through standard university - administered research projects. It provides experiences, incidents, and insight that can positively impact the relevance and quality of a budding professor's classroom teaching. It provides good resume' material and reputation enhancement, the latter for the university as well as the new professor. Of course and often the touchy point with university administrators, consulting provides additional income for the professor, and usually not the university, above and beyond his/her standard university salary; this can be extremely valuable as the new and usually young professor is building a family, buying a house and car, starting an investment program, or paying off education debts, and generally results in a happier, less stressed, and ideally more productive faculty member.

Consulting is, however, not without pitfalls. If not performed “just right,” it can raise some eyebrows among colleagues and particularly superiors at the university. Too ambitious and too rapidly expanding of a consulting “business” can, indeed, become a burdensome time, focus, and travel load on the new professor at a time when he/she should be placing primary focus on establishing himself/herself at the university and becoming tenured and promoted. It can be, in infrequent cases, a real education in regard to others’ (clients’) unrealistic expectations, technical ignorance, greed, less-than-perfect honesty and integrity, and poor communication skills; this is really driven home the first time that a major misunderstanding occurs with a client about the task, its budget, or time frame, or when a client simply refuses to pay.

The paper will discuss such aspects of engineering consulting for a relatively new faculty member within the context of the experiences of the author and colleagues [1, 2, 3] and others [5, 6, 7] on success strategies for new engineering faculty. It will provide hints on how to effectively integrate engineering consulting with a successful career as an engineering educator and researcher, a happy family life, and ongoing personal and professional development.

II. Benefits of Engineering Consulting

The most direct benefit of engineering consulting is the extra income beyond the university salary. This is valuable to the new/young faculty member who is in the process of purchasing automobiles, a house, furniture, etc., often establishing a family, and starting an investment or savings program. This extra income can alleviate financial pressure, ease related stress, and produce a happier individual and potentially more productive faculty member. In some cases, it can make the difference between a spouse having to work and may allow children earlier than if financial pressure dictates that a spouse must work. It also can serve as a cushion for financial emergencies and allow vacations and luxuries that may not be possible otherwise. Considering that engineering consulting work is generally generously compensated, often \$100 per hour or more, one can ring up several thousand dollars of handy extra income with modest time and effort.

However, other benefits are significant. Consulting is an excellent professional development and continuing education tool. All consulting jobs have unique characteristics that require the consultant to learn new information such as applicable regulations and standards, and occasionally new skills or tools such as measuring instruments and software. Due to the widely variable nature of consulting projects, one is exposed to a diverse perspective that helps one to see a unified coherent “forest” containing many different types of “trees.” Related to this is the sense of the “real world” of engineering and business; this is particularly valuable for a young Ph.D. fresh out of graduate school and often with a narrow, discipline-specific “tunnel vision” perspective (“Beware of the man with only a hammer; to him every problem is a nail”). That is, engineering consulting rapidly drives home the fact that design, research, development, and marketing in the nonacademic world are often multidisciplinary in nature. Real problems don’t lend themselves very well to formal academic boundaries and the new engineering consultant rapidly is forced to expand knowledge, skills, and outlook to a variety of disciplines in order to arrive at optimum solutions and interact with clients.

This also rapidly “rubs the rough edges” off of the neophyte and makes him/her savvy in human relations skills such as diplomacy, tact, and negotiation. He/she learns the give and take and mutual back scratching aspects of the world of business and the importance of honesty, proper packaging and timing of proposals and ideas, and the reason that contracts exist; that is “covering one’s tail”. Related communication skills (oral, written, and graphical/computer) are also developed via proposals, reports, and deliverables.

Other constraints (legal, aesthetic, environmental, regulatory, and political) that are peripheral to the technical core of engineering consulting but critical to its ultimate success are brought into sharp focus by thorough discussions with the client. The new consultant learns the skills of digging through regulations, standards, and business documents to pick out the “little gems” relevant to his project.

Engineering consulting emphasizes the overwhelming importance of money, time, and their economic equivalence to real-world engineering and the fact that a consultant always feels short on them in meeting specifications and deadlines. This realization usually helps the new professor better understand the occasional attention to such things in academia and why academic administrators sometimes say “no” to requests or insist that deadlines be met. It also explains why engineering design rarely involves finding the “best” solution but one of several near-“optimum” solutions that meet well-defined client specifications but not “perfection” within budgetary, scheduling, and a multitude of other constraints; this is sometimes not fully grasped by new engineering faculty fresh out of engineering science, analysis, and theory-intensive Ph.D. research programs.

As a consulting business grows, the proprietor must learn time management, accounting, tax, marketing, and quality control skills necessary if that business is to prosper. He/she must also learn how to rapidly, often within hours, assess a potential project and decide upon, find, and acquire the specialized tools or heuristics required to get the job done and make a profit, for example, equipment rental and purchase of specialized standards or documentation. He/she learns that simple, elegant, and even almost trivial solutions, if they meet specifications and constraints, often are superior to complex, sophisticated, and/or theoretical solutions; that is, an ounce of common sense is worth a pound of theory.

With all of the above, this sense of real world engineering and specific examples of such can’t help but positively impact the relevance and wisdom of a new professor’s classroom instruction, particularly in light of recent, for example, ABET’s, increased emphasis on engineering design, ethics, and teamwork.

A rapidly expanding contact network is another benefit of consulting. Just as with compound interest, contacts and business tend to increase exponentially with time as the availability and quality of one’s services is placed on the industry grapevine via word of mouth advertising by satisfied clients. In addition to repeat consulting business and free advertising, these contacts can offer a host of potential benefits to a new engineering educator. They can serve as references or consultants, provide reference letters, be a source of employment for one’s students or for “coop”/“intern” programs, and donate funds and equipment to one’s program within the university. It is also quite common for a history of successful private consulting with a company

to lead to joint industry-university research/development or even instructional projects with industrial funding of projects often “leveraged” through partnership with government programs that fund university-industry collaborations, for example, the Small Business Innovative Research (SBIR) or Technology Transfer (STTR) programs of numerous federal agencies. These contacts can also lead to summer or sabbatical employment for the professor and, in rare cases, a source of full employment if the professor leaves academia. This can be in the form of being an actual employee of a company or a source of business if the professor forms his own full-time “spin-off” business.

A solid consulting record adds to one’s curriculum vitae and is viewed positively by almost any examiner. Consulting is one version of “industrial experience” which is often a key characteristic desired for other jobs or promotions at one’s or another university. “Good press” and a general enhancement of reputation generally ensue. The value of an external engineering consulting record, versus on-campus academic research projects, on university promotion, tenure, and merit raises is a little less universal. There is always a risk that external consulting can be viewed negatively by colleagues and administrators, through jealousy of one’s extra income and success and through a sincere concern that the time spent on such detracts from one’s productivity and carrying his/her load at the university. Thus, a history of excessive consulting, particularly time away from campus, and/or a relatively weak academic research record could be a handicap. On the other hand, a solid on-campus record and a balanced, modest consulting record can usually be used as a plus in the promotion, tenure, and merit raise game in the name of community service, professional development, enhanced relevance of teaching, and, with formal joint industry-university projects, even research/scholarly activity.

A word should be said about nonengineering consulting, other second jobs, or significant moonlighting. In general, this is frowned upon by universities, administrators, and even colleagues, particularly if there is any real or imagined perception that one is not “pulling his weight” at the university or that one is making more money than colleagues. Of course, any sort of regular job during the standard 8-5 M-F business week would be hard to coordinate with class times that usually vary from semester to semester; this would work only with a Chair’s full cooperation. It would be difficult to promote nonengineering/nontechnical work as professional development or teaching enhancement but it still might be interpreted as community service. In general, this route should be avoided by the new engineering professor unless financial factors absolutely demand it; it becomes somewhat more feasible after tenure and promotion to full professor but still usually proves detrimental to one’s subsequent productivity in academia because of the difficulty in symbiotically coupling it to one’s academic duties, as is the excellent “win-win” strategy for engineering consulting work.

The university also experiences benefits from engineering faculty consulting. The quality, relevance, timeliness, and marketability of the education provided engineering students are enhanced; this can’t help, over the long run, but enhance reputation, recruitment/retention of students, and, hence, tuition dollars. Furthermore, joint university-industry research and development projects, sometimes with government support, often ensue from previous independent consulting and can provide the university revenue through indirect/overhead costs, faculty salary savings, other fees, and other resources such as specialized equipment. Universities are adroit at publicizing relationships with industry to their advantage. Sometimes

such projects lead to patents and intellectual property agreements on which the university is a partner and even to royalties, licensing fees, or other ongoing revenue. Even in the case of independent consulting by its faculty, sometimes custom sharing agreements are worked out; for example, the professor can use university laboratory space and nonconsumables such as equipment in return for giving the university a share of his fees, a “win-win-win” situation for all participants.

There is also often a correlation between one’s involvement in consulting and standard university research in that skills and successes in one often motivate involvement in the other, unless the consulting business grows out-of-hand in time demand. Thus, by cooperating with its faculty in consulting, a university usually ends up with faculty more capable and successful in standard university research.

Also, the industry or client benefits from having a pool of experts available at the university but only on the payroll when needed. This saves payroll and expensive fringe benefits in not having to maintain as large a full-time technical staff. Furthermore, generally it can be arranged for the industry, through the faculty consultant, to have access to the university’s laboratory equipment on an as needed basis, again, allowing the client to not tie up capital in purchasing or renting the equipment. The involvement of a Ph.D. academician provides a rigorous, analytical, and theoretical balance to the sometimes too qualitative/conceptual approach to design and problem solving used by B.S.–level “nuts and bolts”, “factory floor” engineers, at least at smaller plants. This may lead to state-of-the-art or esoteric solutions that might be overlooked by the clients’ engineers.

Joint industry-university-funding agency projects, for example, SBIR, STTR, or NSF GOALI programs, are a goldmine for clients, assuming that proprietary features of the project don’t preclude them, in that they directly benefit from research and development paid for by the funding agency. This minimizes the “risk” with innovative ideas and projects and can catalyze profitable future products and services with minimal obligations to the consultant, university, or funding agency.

Again, unless proprietary aspects preclude it, clients, particularly industries, are happy for the publicity that can be arranged for such projects. Also, an intimate relationship with a university through its faculty consultants can often be used to facilitate special institutional programs for its regular employees; for example, short courses, evening courses, workshops, seminars, or tutorials, either on the topic of the previous consulting relationships or other information or skills needed by the company.

Thus, it is clear the engineering consulting for external clients by university engineering faculty can be beneficial to all parties. However, it is not without challenges, pitfalls, and problems if not handled “just right; this is particularly true for young/new faculty without a degree from “the school of hard knocks” and with a compelling need to work hard toward promotion and tenure. The following section will describe these potential difficulties.

III. Problems, Challenges, and Pitfalls of Engineering Consulting for the New/Young Engineering Professor

The first potential problem is the possibility that university faculty might not even be recognized as a technical resource by regional business and industry; this is especially problematic at smaller institutions and/or those in nonmetropolitan areas. Such schools may have historical reputations as “teaching” institutions, be limited in the number and types of technical programs, types of faculty expertise, reputation for scholarship and research, and facilities and equipment, and may simply be overlooked. Usually, this can be overcome by faculty diplomatically initiating contact with engineers and managers at potential client industries. Exchanged seminars, field trips to the industries, open houses, short courses/workshops at the university, and discussions of student intern programs can serve as ice breakers and establish a rapport which can be followed by offering and selling ones’ services in a direct manner.

In other cases, industry may be well aware of technical expertise at universities but may be hesitant to utilize it. The industry may have been “burned” in the past with ineffective academic consultants. It may be afraid of the cost (~ \$100/hour) for Ph.D. consultants and, in some cases, university administrative, equipment use, or profit sharing fees. The industry might rather let their full-time technical staff, which is much cheaper on a per hour per individual basis, flounder around with the problem than hire an outside high priced expert although this is generally more expensive in the long run.

The industry might be intimidated by contracts and other paperwork/“red-tape” associated with retaining an academic consultant, particularly if the university has to be included due to use of its facilities and equipment. The industry might be aware of the standard sluggishness and long time constants associated with academicians and university bureaucracy.

If in different cities or otherwise geographically separated, the industry might be afraid of the long distance relationship with associated travel, shipping, and long distance telephone features that prevent it from assessing project progress than if it was close by. This is exacerbated by a sense of loose accountability with academicians in an academic environment; namely what recourse does the client have if the consultant fails to do the job satisfactorily?

Furthermore, there often exists a general distrust of and contempt for academicians with their perceived “theoretical,” “prima donna,” “ivory tower” mentalities. This is particularly true of smaller industries in nonmetropolitan areas with no Ph.D.’s (and often no Master degree recipients) on their staff and sometimes few Bachelor-level college graduates at all, even among the “engineering” staff. The staff might feel threatened by bringing in someone “superior” to them in technical ability. They might also feel a new/young engineering professor is still only a “kid.”

The above perceptions can be addressed only by an ongoing, sensitive, and low key nurturing of relationships with key industrial personnel and letting them know in a nonthreatening manner of one’s interest and capability in helping with their problems. It may take some time but generally they will come around, often when a “crisis” suddenly occurs. One must convince them that “it is worth the hassle” to retain an academic engineering consultant.

There are often significant differences in outlook and definition of value/wealth between industry and academia that can lead to misunderstandings and major differences in the “modus operandi” unless both are aware of these. The following is a comparison/contrast between stereotypical positions associated with “Real World Wealth” and “Academic Wealth.”

REAL WORLD	ACADEMIA
1. Short-term perspective (wants it done yesterday).	1. Longer-term perspective (will get around to it after the current project is finished; translated weeks to months).
2. Pragmatic/“bottom line.”	2. Perfectionistic/theoretical/artistic.
3. Pursues research and development for profit.	3. Pursues research and development for the sake of knowledge, scholarly productivity, reputation, and artistic/creative expression.
4. Facilitates results through hierarchy and chain of command.	4. Facilitates results through freedom of expression, personal creativity, and academic freedom.
5. Personnel may be allowed to focus on a single project.	5. Personnel have to balance/juggle a multitude of projects and time demands with a scattering of focus.
6. Personnel are well-versed in the background and details of the problem.	6. Consultants enter the project “cold” and must go through an incubation/learning period before results will ensue.
7. Personnel are not expected to know everything.	7. Ph.D. consultants are expected to know everything about everything even remotely connected to their field at a moment’s notice.

The differences are often deeply imbedded in the subconsciouses of the represented personnel and are related to how they approach any problem.

A related dichotomy is that of the “Professional Doctor/Attorney Model” versus the “Technician/Repairman Model” as applied to engineering consultants and how they are viewed by themselves and the client industries.

PROFESSIONAL

1. Intellectually challenging problems with no guaranteed cut-and-dried answers.
2. Problem attack may require extensive analysis, research, and testing to uncover root problem (not always the surface symptoms).
3. The optimum solution may require creativity and innovation.
4. Problem solving is generally spread over a significant time period with multiple appointments and/or episodes.
5. Payment is generously based upon effort and time and, not necessarily, final results or success.
6. The client is buying intelligence, knowledge, time, and a good faith effort toward a solution.

TECHNICIAN

1. Skill-oriented problems usually fairly “cookbook” in nature.
2. Diagnosis of the problem cause is generally straightforward to a trained individual.
3. Solutions are generally by-the-book.
4. The problem is generally solved in 1-2 closely spaced episodes.
5. Payment is generally based upon successful solution of the problem, although total time expended and supply costs are also factors.
6. The client expects a rapid, complete solution at a low cost.

Because of the technical nature of engineering and science, clients try their best to invoke the Technician Model for high level, open-ended engineering problems that require the Professional Model. LET THE SELLER (consultant) BEWARE.

IV. Minimization of Industry – University Mismatch/Culture Shock

Although the new professor must tread carefully within the university system to effectively build and sustain an engineering consulting business and avoid getting bitten, the two above dichotomies produce even more pitfalls in dealings with the client business. However, there are strategies that the consultant, client, and university should use to minimize these.

First, NONE OF THEM SHOULD ASSUME ANYTHING. Assumptions and associated poor communication are the primary source of conflict in such consulting relationships.

Everything should be defined, preferably in writing (but not necessarily contractually). The following details are particularly in need of unambiguous definition:

- (1) Project objectives, milestones, and deliverables (including reports) (WHAT the client expects.
- (2) Deadlines and whether they are firm or flexible (WHEN he expects it).
- (3) The client personnel with whom the consultant will interact and be responsible and any paid assistants or subcontractors to the consultant (The WHO of the project).
- (4) Any on-site work or other travel required (The WHERE of the project).
- (5) Any critical or proprietary information or documentation that will be required to complete the job, other background or explanatory information (including potential market) and where to obtain it (WHY the work is desired).
- (6) Financial details such as project budget, reimbursable costs, fees/salary, and royalties or profit sharing.
- (7) Confidentiality/publishability,
- (8) Particular methodologies, criteria, standards, or legal/regulatory features that must be followed.
- (9) Any other constraints, particularly on the faculty consultant, impacting the work (available time, other duties, equipment available, etc.) and the “penalty” for circumventing such.
- (10) Importance and rigor versus flexibility of all details.
((6)-(10) are the HOW of the project).

Assumptions or misunderstandings in any of these can derail a project and lead to bad will, missed deadlines, nonpayment, or worse (lawsuits, indictments, etc.). Although these should be verbally discussed with the client; it is critical that, at least, the essentials be written in some form. This can be in the form of a simple letter-of-agreement to detailed attorney-prepared contracts. However, verbal “gentlemen’s agreements” or “oral contracts” are highly dangerous if not backed up with written documentation; slightly modifying a couple of old maxims: the palest ink is better than the best memory and an oral agreement is as good as its weakest (or most dishonest) memory. Insist on some form of written documentation of the project “rules”.

On the other hand, this needs to be done in a low-key manner so as not irritate the client. In general, it is best if the consultant and client negotiate and document the arrangement with as little direct involvement of the university as possible (usually none) unless the project will utilize university resources or otherwise impact it in some manner. The faculty consultant can quickly lose control of the situation and end up being told what to do by university administrators in a new “university-industry partnership/initiative” if not very careful. Furthermore, the client can quickly be turned off by university “nit-picking” about details, particularly financial details.

The faculty consultant and client should aim for a mutually beneficial and comfortable arrangement by reasonable compromise on both sides. A little give-and-take here will enhance rapport and trust and streamline all aspects of the project.

Unless the project is extremely large or complicated, efforts should be made to streamline all legalism, legalese, and paperwork and minimize participation of attorneys and bureaucracy, except, for perhaps, in the final “checking it over” stages. Binding contractual agreements, if

needed, can be adequately prepared in most cases by other educated, articulate professionals, namely the consultant and the client's contact person. ON THE OTHER HAND, the consultant must always make sure that ALL relevant laws, regulations, accounting/tax concerns, professional licensing/competence factors, and professional ethics are squared away and if there are doubts about these, proper legal, accountant, or other professional advice should be obtained (but to the minimum extent possible so as to avoid complexity and expense). The objective in the agreement is to "cover one's tail" adequately but not more than adequately.

Fees, fee schedules, and other financial details are particularly important and must be thoroughly understood and acceptable by all parties. All consultants will eventually encounter a client who refuses to pay due to dishonesty, financial difficulties, or lack of satisfaction with the consultant's results. The agreement must include whether the consultant is to be paid for good faith effort and incremental progress with no guarantee of final success in solving the problem or for completion/final success. In general, the faculty consultant should try to negotiate an up-front retainer or earnest fee and periodic payments (weekly, monthly, or at intermediate milestones) throughout the course of any prolonged projects. This protects both the client and consultant from unpleasant surprises at the end of the project and, in most cases, actually is beneficial to the client by producing good will and motivation on both sides.

Frequent communication is also essential both to produce good rapport between consultant and client and to discuss inevitable problems, possible solutions, and other "mid-stream" changes in the project. Don't assume that just because the project has supposedly been defined up-front that changes in plans and perspectives won't occur on both sides. Periodic telephone calls, e-mails, interim reports, and even meetings will serve as the lubricant that provides ongoing corrective feedback early and avoids possible misunderstandings. Remember that follow-up consulting projects with the same client will depend just as much on the personnel relationship(s) that are developed as the client's satisfaction with the results of the project. Any suspicion or bad will on either side may kill any chance of an ongoing relationship.

In addition to a fee charged for the time and effort spent on a project, the consultant has the option of asking for reimbursement for supplies, equipment, travel, clerical services, communications, and shipping charges. A word of caution is in order. If one gets too "nit-picky" in passing all little expenses on to the client, he/she will come across as petty. Reimbursable expenses should be agreed upon at the beginning of the project and, to avoid irritating the client with trivia, the consultant may opt to absorb minor, infrequent expenses within the context of the generous consulting fees that he/she will receive.

Similarly, one needs to be reasonable in the time charged to the client. Sometimes there are differences of opinion as to whether the initial consultation meeting should be charged to the client. Generally this is the norm, but it is still a good idea to mention to the client at the very beginning whether one plans to charge for the initial discussion and follow-up meetings. On the other hand, one may again come across as petty if every 5-10 minute phone call is charged as consulting time. Common sense should dictate what is reasonable, again in light of the generous fees generally charged for the bulk of the work. Always keep in mind that although the client may be paying for the consultant's time and effort, fundamentally he/she is interested only in bottom line results and the quicker and cheaper the better.

It is also generally worthwhile to emphasize to the client that although one will abide by written provisions of the project agreement, a university does not operate like a normal business. That is, faculty must balance and juggle a multitude of diverse responsibilities and rarely will have the luxury of being able to focus exclusively on the consulting task-at-hand. Industrial types often have great trouble in recognizing or accepting this fact and expect miraculous results to be delivered yesterday. One must negotiate, up-front, sufficient time to get the consulting job done on top of normal university and family responsibilities without working 23 hours per day. If the client insists on impossible deadlines, the project may best be passed up. On the other hand, the consultant owes it to the client to expedite progress to the extent feasible and not drag the project out over weeks and months. Always recall that when one take his/her automobile to the garage for repair, one wants it repaired by quitting time that day and has little sympathy with the mechanic's excuse that he has a lot of other cars to repair, that his children are sick, or his lawn needs mowing. It's generally worthwhile to push hard at the beginning of a project to get a step ahead of the client's expectations and to allow for a little slack down the road when problems or other responsibilities arise. Initial progress will also reassure the client that he has made a wise choice for a consultant.

Also it is wise to be frank with the client and tell him/her that one is not an expert in their narrow field but a broadly and deeply educated professional that can solve his/her problem but only after a little "incubation time" up-front to "come up to spend" on the details and background of the project. Again, clients often expect Ph.D. engineers to know everything about everything at a moment's notice and may become disillusioned if/when they don't unless this is discussed up front.

In the final analysis, a little common sense and application of "the Golden Rule" will go a long way toward avoiding dissatisfaction on both sides. When added to frequent communication between client and consultant, they generally will lead to satisfaction, even delight, among all parties.

V. Streamlining Things with the University, Family, and Self

The engineering faculty consultant must never forget that his/her loyalties must lie first with his/her family, second, to his/her primary employer, the university, and only then to the external client. It is essential that all of these constituents be provided the proper amount of time and attention within 24 hours per day and repeated deadlines in all facets of life; this is often difficult. When added to the consultant's own needs for rest, sleep, recreation, exercise, religious worship, and personal and household maintenance, it can become nearly impossible unless a healthy dose of "Academic Balance" is maintained by constant vigilance.

At the university, the consultant must bend over backwards to avoid even the slightest perception by others that he/she is shirking professional responsibilities. Otherwise, the rumor mill can quickly make a mountain out of a molehill. Missing appointments, forgetting to make out a test or taking a month to grade it, or not being on-campus when students or visitors inquire as to one's whereabouts can all quickly snowball into a reputation of not doing one's job. Well defined and followed office hours are a must. If at a university known to support consulting by

its faculty, it is a good idea to let one's Chair know of the activity. If at a university known to discourage consulting, one should try to avoid any conspicuous consulting activities, should try to make an appearance in the office daily, ask the secretary to call home if anything transpires that one needs to know, and again make sure that all university duties are always fulfilled.

It is also not a good idea to boast about or flaunt the results of extra consulting income. Colleagues will quickly begin to burn with jealousy, particularly if they are dedicating themselves entirely to university duties, often with meager merit pay increases for such.

It often helps if one can legitimize such activity by making the university a limited partner in some token manner. Promises of a donation to the university by the client company in gratitude for its cooperation, a reasonable, preferably token, profit sharing arrangement, publicity of the faculty-university-client "partnership" in the press, and other token benefits will often greatly enhance university cooperation. It is also a good idea to arrange things so that one's direct superiors also benefit from the publicity or other rewards; that is, make everyone and all administrative units look good and, when possible, reap some tangible benefit.

Although a spouse's concern with the consultant "burning the midnight oil" can usually be appeased somewhat by reminders of how handy the extra income will be, this is still not a full consolation. Young children will be even less satisfied with this response. It is imperative that time management skills be used fully to maximize efficiency, effectiveness, and quality in all aspects of life so that there is adequate time left for one's family and personal needs. With limited consulting, this may be as simple as working on the project after the children go to bed but with a rapidly blossoming business, may require that only a fixed number of hours per week be "budgeted" for consulting and that prospective clients be advised up-front of when one can commence work on their projects. One may occasionally irritate or lose a client by this strategy, but one will retain the far more valuable happy family and personal life. In cases in which consulting opportunities multiply faster than they can be accommodated, one should consider either shunting them off entirely to other qualified colleagues with the understanding that they will return the favor sometime, recommending professional consulting firms, or subcontracting with colleagues or even students to work on them. This will keep the prospective client happy, will minimize one's own overload, and produce good will and favors owed by colleagues. If necessary, one can formally limit the types of projects accepted, for example, only those involving, say, power systems rather than all areas of electrical engineering; that is, offer services in only a narrow area of expertise assuming that sufficient projects exist therein.

Lastly, one must not let the time demands and stress of the extra work take a personal toll on happiness, peace, or health. Exercise, rest, sleep, recreation, and reading must also not be neglected in the name of making a few extra bucks. It all boils down to values and priorities. A mature individual with a well defined set of values and priorities normally will be able to balance most aspects of his/her life most of the time. It's only with an extreme preoccupation with success, money, or fame, or sometimes simply the inability to say "no" that problems develop and the bubble begins to burst. As in all areas of life, moderation and balance are the key to happiness.

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ROBERT ENGELKEN

Dr. Robert D. Engelken was born on November 14, 1955 in Poplar Bluff, Missouri. He graduated from Walnut Ridge, Arkansas High School in 1974, obtained the B.S. - Physics from Arkansas State University in 1978, and the M.S.E.E. and Ph.D.-E.E. from the University of Missouri-Rolla in 1980 and 1983, respectively. He has been on the engineering faculty at Arkansas State University since 1982, is currently a Professor of Electrical Engineering, and is a Professional Engineer in the state of Arkansas. He has been very active in research and development in the field of semiconductor thin films, particularly in the fields of electrodeposition and chemical precipitation deposition of such, with a major emphasis on undergraduate instruction and utilization of undergraduate research assistants in the field. He has had numerous research projects sponsored by agencies such as NASA, the National Science Foundation, the National Institutes of Health, and the Arkansas Science and Technology Authority. He also has played an active, senior role in the development of the relatively young electrical engineering program at ASU and has been active in the field of engineering education, including several presentations and papers at ASEE/IEEE Frontiers in Education and ASEE annual conferences. He has been active in ASEE, IEEE (including serving as Faculty Counselor to the ASU IEEE Student Branch), the Electrochemical Society, the Arkansas Academy of Science, the American Physical Society, and Sigma Xi. He is married and has two sons.