So you want to be a consultant . . .

. . . remember to keep in mind that the rewards can be great, but so can the penalties for failure

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☐ When the company parking lot begins to look gray and familiar, many electronics engineers start dreaming about challenge and diversity. They often come to feel that a good way to achieve independence is consulting—a way of life that also draws EEs who make the move at the outset of their careers, as well as those who are between jobs or have time to moonlight.

But deciding to be a consulting engineer is a lot easier than becoming one. Most prospective consultants are not aware of the range of potential jobs, much less how to get them. Nor are they familiar with the business side, especially fees and contracts, or with the special problems a consultant faces on the job.

Necessary traits

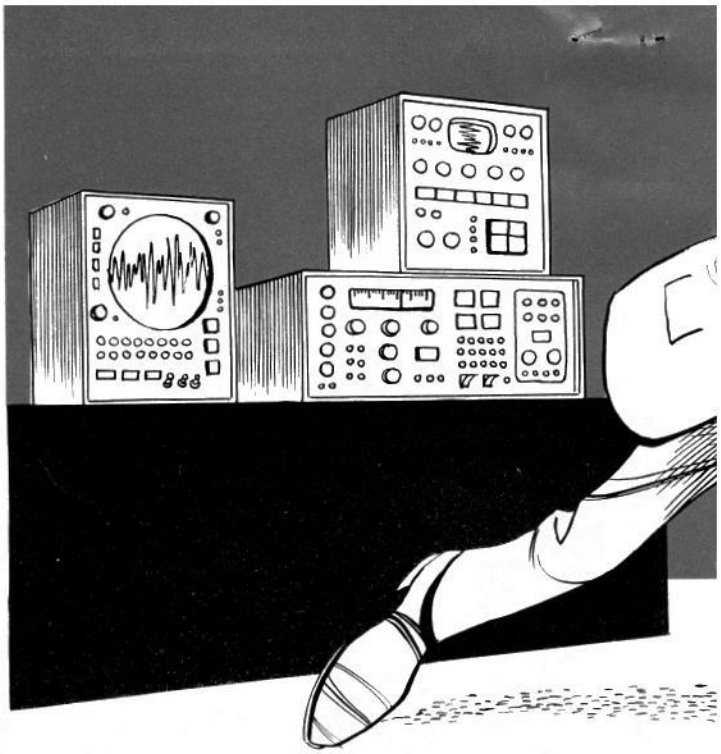
Engineering consulting can be challenging, profitable, and just plain fun. But it can also be a nightmarish conflict between the consultant and his clients involving lost time, overestimation of abilities, poor decisions, and worse. A sobering fact is the failure of the majority of engineers calling themselves consultants to establish a going business. Most of them should not have gone into consulting in the first place.

What separates the winners from the losers? Successful consultants all seem to have the ability to listen, the facility to think fast and clearly under pressure, self-confidence based on technical expertise and experience, a high level of motivation and interest in engineering, and salesmanship. Of course, these traits apply to almost any successful engineer, so you might say that a successful consulting engineer is first and foremost a fine engineer with a little something extra.

The vision of consultants as mental giants who should be able to do anything is wrong. In many situations, the consultant is part of a team effort; very often he and his client will augment each other's know-how. Therefore it is wise for a client to know from the beginning what the consultant can and cannot do.

A smart consultant does not promise the moon in an eager attempt to land a contract. Trying to con a client

One danger is getting caught between conflicting personalities in a company



into believing that you can do something you cannot deliver is simply asking for a damaged reputation, a lawsuit, or both.

The projects open to the consulting engineer vary widely. Usually a firm hires a consultant to provide a specialty it lacks or backup in technologies in which it is weak. I once worked for an optical-equipment manufacturer needing an oven that would cool down at a precise rate over several thousand hours. The firm could not buy it and did not know how to make it.

What consultants do

Many companies rely on outside help to get them started in a new product line while they develop in-house expertise. A good example is a project I did for a digital-equipment manufacturer. The firm wanted to come out with a line of low-level analog modules to plug into its existing digital systems. My duties included both startup design for the modules and interviewing candidates for the company's newly formed analog design team.

Electronics manufacturers often farm out specific tasks as well. For instance, I developed a production instrument for a maker of a certain type of environmental sensor. The sensor design itself was fine, but management wanted to add to the sales catalog an instrument designed around it. The firm was not willing to invest in a full-time engineer for a single new product.

Rescue operations are another form of consulting work. I once got a call from a firm where the senior engineer had died suddenly. He had been working on a new instrument, but had left almost no documentation, no specifications, no trimming procedures, no production tolerances, and no complete schematics.

It was a tight situation; time was short and cash flow limited, so the company needed a crash rescue operation. To finish the job, I sat down at the bench with what notes there were and the prototypes. From these I put together production schematics and created the other documentation required to get into production.

Another rescue involved a case where thousands of high-quality printed boards had been made up in advance for a circuit that did not work. These multilayer boards were tightly laid out, perfectly etched, precision-drilled, and very expensive. The problem was to get the circuit to work perfectly without altering the boards. In addition, there were restrictions on weight, power consumption, component size, and operating temperatures. And there could be no fudging on performance.

It was one of the most difficult assignments a consultant could get. The solution came down to analyzing the combination of functions and patterns that would perform to spec and conform to the board. It meant changing some components and changing values on others, a maddening procedure given the limits imposed.

Teaching is a possibility

Another possibility for a consultant is teaching special courses. Many companies prefer bringing the teacher to the students, rather than sending engineers to extension courses or night school. The advantages include lower cost, less time lost, and control over course content.

I have taught in-house courses in which the content was tailored to technologies the company was entering. One three-week course was a concentrated study of low-level analog circuits. Circuit performance and quality were the main concerns, with cost a secondary consideration. Another firm wanted its engineers to learn how to cut costs. So I taught a course on design shortcuts, such as one- and two-chip solutions to problems that appeared to require half a dozen integrated circuits.

Two other areas in which consultants sometimes work are technical writing and equipment-purchase recommendations. Data sheets, application notes, manuals, and even magazine articles are often farmed out in order to meet deadlines for the introduction of new products. As for purchasing recommendations, some firms hire a

consultant because their personnel have little background in electronics. Such a customer wants to make sure that it is spending money wisely in choosing test instruments and the like.

Along this line, I have also been asked to analyze competitive products. A circuit house, for instance, wanted to evaluate its high-grade chopper-stabilized amplifier against that of a competitor. The objective was to decide whether to expand its line to include models with features similar to the competitive unit.

Another form of consulting is developing a product design or patent independently and then selling it outright to a company that will manufacture it. The design effort can include anything from a black-box function to a complete instrument.

Finding work takes persistence

So much for the types of work available to the consultant. The next problem is how to land a job.

The key to getting work is mastering the art of thoughtful aggression—that is, spotting a potential opening and going after it. It means reading engineering periodicals to keep up to date on who is doing what. Is XYZ Inc. going into a new business? Do prices at ABC Corp. seem too high? Do product trends indicate an established firm is falling behind more progressive newcomers? Any one of these companies may be in the market for help from a consultant.

Besides the engineering magazines, general business publications can also provide leads. Say Acme Shoe Co. reports it is planning to spend a few million dollars on automating production—an inquiry is in order. Or suppose Ajax Cardboard Corp. decides to diversify into data-processing products—business may be waiting.

Look at products you use yourself. Do they work well? Could you do a better design job? What about companion products, additional features, and the like? Are the data sheets or technical manuals clearly written and well illustrated? My first consulting project involved a premium product of top performance that I had been using. The data sheet was dull and poorly written, and the applications in it did not do justice to the product. I called and got the job of rewriting the data sheet.

Exposure on conference or symposium programs and in magazine articles is important too. The more work a consultant does, the more often other opportunities come his way by word of mouth.

Generally, though, the consultant has to approach the potential client—and this inquiry has to be well planned. A letter is one way to start, but a telephone call to the president or other high officer in the company is often better. It is always best to go to the top of a company first. Once you interest a key executive, the doors will open, whereas middle-echelon personnel may either feel threatened by a consultant or simply not have the authority to start the ball rolling.

The letter or telephone call should get straight to the point. The consultant describes who he is and how he thinks he can be of service in as specific terms as possible. Suggestions for a new product or a product upgrading should also be straightforward in order to provide the executive with enough information for evaluation without overwhelming him with details.

Very few consulting contracts are arranged without a meeting. Often a serious prospective client will offer to pay travel expenses for a preliminary get-together. However, once a contract is drawn up, travel expenses should be explicitly provided for or else lumped together with the total charge for the job.

When a company shows real interest, respond quickly. If you started with a telephone call, then a letter should follow, restating the conversation. If a letter spawned interest, then perhaps a telephone call is in order. The idea is to get negotiations moving quickly without becoming pushy. Sometimes a company simply cannot reply immediately because of size or internal communi-

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cations difficulties. In any case, the consultant has to be ready to talk when the prospect is ready.

The period between initial approach and contract meeting is a good time for the consultant to get his case together. When the call comes, he will be ready with a plan and a fee to begin negotiations. After holding initial meetings, the consultant usually will write proposals, which are evaluated, discussed, and often revised.

Inventions: a special case

Finding a company to market an invention is probably harder than dreaming up the product. Knowing what design idea is saleable, to whom, when, and for what price are complex matters. And the lone engineering consultant trying to sell an idea is in a vulnerable position. Negotiations often resemble a poker game.

Some guidelines might be helpful, however. First, decide what the product is worth and do not sell for less. Of course, this decision involves considerable background research. You must estimate production costs, overhead, profit margin, marketability, and product life—all factors that the company probably knows quite well.

Negotiations over selling a product can go on for an incredibly long time and can appear fruitless. However, drawing out the discussions is often a tactic on the part of the company to shake the product loose from the disheartened inventor. So it is wise not to give into low bids or delaying tactics if you are confident that your product is a winner and if you have done your cost-analysis homework. Needless to say, competent legal advice should be sought before signing anything.

The business side of consulting is extremely important, yet it is surprising how sloppy many consultants are in this area. Only after listening to a prospective client's problem and making sure that it is understood, can a consultant come to a meaningful figure for the fee.

It is wise to enter a situation with a ballpark figure in mind, but the nature of the project may have changed since your initial approach, or else the project may not have been adequately communicated in the first place. It is important to look out for these stumbling blocks before discussing the fee.

In any case, the most common error of novice consultants is setting the fee too low. Two hundred dollars a day and up is a common figure these days. The main thing is to be paid a fair amount. Occasionally companies will offer a royalty arrangement in place of direct payment or some combination of the two.

Every so often a company is in a great hurry to get something done and is willing to pay anything, no questions asked. I once got a call from a California outfit. The president explained that his staff had underestimated the problems in building an oven to maintain a stable temperature of 65°C to within 25 microdegrees.

Speed means money

The company, a subcontractor, had built a large system, left the oven until last, and had a site inspection scheduled in four days. Afraid of losing all or part of the subcontract, the company offered a flat $5,000 fee to get a control system up and running. With a number of technicians and machinists helping, the control loop was running after 40 hours of nonstop work.

Whatever the fee agreement, it is important to draw up a contract. Some consultants are afraid of insulting a potential customer by insisting on a contract, but this fear is unfounded. A contract provides a record of the agreement to avoid any misunderstandings and to protect both parties. Managers understand this.

Some contracts call for all the work to be completed before payment is made. Others provide for partial payments as certain contractually defined phases of a project are completed. Still others provide a retainer payment before any work begins. Usually the client prepares the contract and sends it to the consultant, who edits it and returns it. A contract may go back and forth two or three times before both are ready to sign.

Most contracts are relatively simple and pose no problem. On very rare occasions, the consultant runs into a client who is dishonest and refuses to pay. If this happens, it is best to try to remind him, or to reach an understanding—but be firm. If the client does not respond, it may be necessary to retain a lawyer. However, a consultant should never threaten legal action as a bluff, since the client may call him on it.

Doing the job

Once a contract has been drawn up, work finally begins. At this point, the employer should have a clear idea of what the consultant's approach is and how he will solve a particular problem.

Above all, the consultant has to be prepared to recognize and correct a situation if it is not working out as planned. There is often a great deal of pressure from clients to get a project done on time within budget. It is difficult to walk into an unfamiliar situation and take charge immediately, yet clients want quick solutions, not excuses and complaints.

A potentially sticky problem arises when a consultant becomes caught between conflicting personalities in a company. Company politics, power struggles, petty games, jealousy, obstinacy, and plain stupidity often lurk in corporations and can easily trip up an unsuspecting consultant.

In one project, I worked for a company in which the test equipment was poor and out of calibration, the work area was poorly lit, the laboratory was a mess, and the so-called engineering staff did nothing but cash their paychecks. I did my work, made sure the firm was satisfied, and got out, glad to be free of the place.

However, if a consultant gets caught on a dead-end street, the best policy is to speak out plainly but tactfully. Discuss the problems with the managers involved to define who is in charge of what, who is responsible for the project, and where you fit into the picture.

Even though the circumstances may not be ideal, the main objective is to get the job done without blowing up or entering into pointless power struggles. There are exceptions to this policy. One group I worked with turned out to be willing to put products out the door that just were not ready to go. I did not want my reputation ruined by these bad products, so I resigned and told the company why.

Most jobs can be completed with minimal difficulty if you act professionally, provide first-rate documentation, and meet all deadlines. It is a good idea to call the client back several weeks after the project is completed to make sure he is still satisfied. This is an excellent way to drum up follow-on business, as well.

It is vital that a consultant maintain confidentiality. Many companies do not want it known that they hire consultants, much less what for. Sometimes a firm is reluctant to hire someone who has worked for a direct competitor. Much more troublesome are companies who want to find out what a consultant's former clients are doing. In the long run, it is in your best interest to tell them nothing, because word of unethical practices will get out eventually.

It can be done

Starting a consulting practice from scratch is difficult, but not impossible. If you are working for a company and thinking of going into consulting, cash savings will make the transition a lot less bumpy. There are some engineers who left companies, worked hard, and put together a consulting business from literally nothing.

Whether consulting becomes a transitional phase or the end point in a career is up to the individual. I have found it rewarding, challenging, and educational. It provides variety, independence, and opportunity to the engineer who seeks these rewards in his career. □

The pros and cons of consulting

Consulting offers a number of advantages to the electrical engineer. But there are also a number of drawbacks to keep in mind.

On the plus side, consulting offers broad exposure to engineering. A consultant is called upon to solve a variety of problems and can usually choose assignments that interest him.

In addition, the consultant works with a wide variety of people in a range of companies. In a month he may see the inside of more companies than the average engineer sees in a lifetime.

The consultant's professional life is relatively autonomous. He can set his own hours; that is, he can work the hours needed to do a job, rather than following a daily routine. Successful consultants take home more income than full-time engineers, set their own vacation schedule, and usually travel more than do most steadily employed engineers. Fees range from $25 an hour for beginners to $50–$75 an hour for established consultants, with the very best getting $100 an hour. Annual income can run from $30,000 up to $75,000.

The consultant's life is probably riskier than the average engineer's. He must first of all dig up his own jobs, for there is no paycheck waiting for him if he has a bad month. And he has to be much more skilled in business management, law, and contract negotiations.

Fringe benefits, pension plans, and the like must be self-provided. Equipment and literature must be purchased, often money risked to land a contract.

In addition, prospective clients can drag out decisions for weeks or months, keeping a consultant on pins and needles. To justify his higher fees, a consultant must study more, work harder, and produce superior solutions faster than other engineers.

Salaried engineers who feel career insecurity, appreciate their fringe benefits and pensions, and fear technological obsolescence will make unhappy consultants. After all, the consulting engineer has the same economic concerns as everyone else—only more leeway in determining his fate.