PDHonline Course G469 (2 PDH)

Owning and Operating a Small Engineering Company

Instructor: John C. Huang, Ph.D, PE

2020

PDH Online | PDH Center

5272 Meadow Estates Drive
Fairfax, VA 22030-6658
Phone: 703-988-0088
www.PDHonline.com

An Approved Continuing Education Provider

Owning and Operating a Small Engineering Company

W.N. Weaver, PE and John C. Huang, PhD, PE

INTRODUCTION

At some time during their careers most engineers will consider opening their own companies and some small percentage will accomplish the task. Most of those who do will discover some truth in the old sentiment "The nice thing about owning your own company is you only have to work half time, choose any twelve hours out of the day."

As daunting as it may seem the startup task has been made very simple in most parts of the United States. In some places merely being a resident and being a registered engineer are all the permission one needs. Other states require considerable paperwork and money. Because of the many variables involved we will not explore in any depth the legal aspects of starting an engineering company.

Working as a single individual consultant is generally the least expensive and least complicated. This also eliminates a lot of non-engineering problems from the process. Recognizing that beginning as a company of "one" and growing to whatever size is desired moves one from doing the actual work to supervising all work and doing none of it yourself. Managing yourself verses managing a large engineering force changes the entire aspect of having your own company.

FOR FUN OR PROFIT

The implication of the title of this section might seem out of place in a serious discussion of the idea of running an engineering company. There are several prime reasons to owning your own engineering company:

Financial
Independence
Reduced nonessential work load imposed by "Corporate"
Pride
Freedom to act in your own best interest
The opportunity to create a better company with your values
and
Fun

The owner of a company with 26,000 employees (6,000 engineers) once told me "If you're not having fun you're in the wrong job!" More to the point if you're not happy with the engineering company you've created then you need to make changes; as you age money worries, long days and frustration are rarely adequately compensated for with money. The reason to understand this is it helps to set up the company structure and legal work to make changing things simple.

Owning a company and having the responsibility for the economic welfare of employees is a serious and frequently worrisome task that should not be taken on lightly. It requires

commitment and long hours; when your employees have gone home for the day you'll frequently find yourself struggling with non-engineering but essential tasks late into the day. Maintaining sufficient backlog of work to keep all of the employees working is a constant task and affects all other activities you might think you need to do; this one aspect can stop you from doing any actual engineering work.

You must understand up front that although you may be creating jobs for your employees this entity is not your job but must hold some of your passion and a lot more effort than a mere job would demand. To assume you are creating employment for yourself is a serious mistake in this effort.

It is critical to determine what you want to do and be within the company before you proceed too far and finding answers to the following questions can assist:

- Do I want to do engineering or managing?
- Do I want to become involved in sales and contract efforts?
- How long might I have to do all the work before I can expand and concentrate on the parts I like?
- Do I actually have good data on how much of my time will be spent doing non-engineering work?
- How will operating this company impact my home life; can my family finances survive while I build the company? Is my family willing to accept the risks and sacrifices involved?

TYPES OF ENGINEERING COMPANIES

Once you've made the basic decision to proceed there are several questions to be answered:

- What type of engineering company do I want this to be?
- How large do I want the company to be?

There are generally two types of engineering companies as follows: Specialty Services onlyandFull Service. Offerings from these two entities usually include the following from in house staff:

Specialty Services only
One or two engineering disciplines
Perhaps design

Full Service
Mechanical Engineering
Civil Engineering
Structural Engineering
Chemical Engineering (Process)
Electrical Engineering
Project Management

Cost Control
Procurement
Scheduling
Design for all disciplines

If you select to be a specialty services company then you can operate with just yourself or with a relatively small staff all specializing in one particular discipline. For example you may choose to specialize in structural steel design for steel buildings; this leads to the challenge of finding sufficient work to keep the company viable. You need to consider the answers to the following questions if you choose to be a specialty shop.

1. Is there enough demand for the services I want to offer in the geographical area where we are located?
2. Are there already enough companies offering design in my chosen area that the local competition is very strong?
3. Can the local work available support another company?
4. Do I offer some technique or specialty within this discipline to attract customers?
5. Do I have strong connections to some local industry which will give me an edge in obtaining sufficient startup work?
    a. Will this connection last long enough for me to become solidly established and able to survive without the connection?

There are several approaches to creating a full service engineering company:

- Begin as a specialty company and expand as your company develops a customer base
- Start the company with several individuals of different disciplines
- Once established as a specialty company merge with or purchase additional companies to provide additional disciplines

As the company gets larger other questions need to be added to1 through 5 above:

6. Is there enough work for the number of employees we expect to have?
7. Do we need to increase the sales force in order to keep everyone busy?
8. Do we need to expand our geographical area of service in order to have enough work to keep everyone busy?
9. Do we need to add specific specialists (safety, fire control design, etc.) in order to become full service in our area?
10. Do we need more office space? Equipment?

SIZES OF ENGINEERING COMPANIES

Engineering companies range from one person to many thousands of employees. For simplicity the information and concepts presented here will be limited to companies of about 50 persons maximum. Large engineering companies numbering in the thousands will require equally large support staffs and facilities.

The staff size depends on the work load and type of work taken. Generally you want to have a staff capable of the most common types of work in your area of service. In today's world companies frequently bid on work outside their geographical area and if offering a specialty service perhaps anywhere on the globe.

Generally speaking the larger the company the further removed from engineering work the owner finds him or herself.

Let's create a fictional engineering company of approximately 50 people: We'll add 10% to base salaries to cover various taxes (FICA, Unemployment, etc.), the basis being paying the individual for 2080 hours a year.

Position	Quantity	Hourly Cost	Total, yearly
CEO / President	1	$96	$200,000
Office Manager	1	$60	$124,800
Engineering Manager	2	$60	$249,600
Mechanical Engineer	4	$49	$407,680
Electrical Engineer	4	$49	$407,680
Structural Engineer	2	$49	$203,840
Chemical Engineer	2	$49	$203,840
Mechanical Designer	5	$30	$312,000
Electrical Designer	7	$30	$436,800
Structural Designer	3	$30	$187,200
Piping Designer	4	$30	$249,600
Drafter	2	$20	$83,200
Secretaries	2	$20	$83,200
Accounting / Clerical	3	$20	$124,800
Print Room	1	$20	$41,600
IT	2	$30	$124,800
Sales	2	$50	$208,000
HR / Personnel	1	$25	$52,000
Rent			$6,000
Heat / AC			$3,000
Electrical			$3,000
Office Supplies			$2,000
Internet			$1,080
Liability, Errors and Omissions, etc. insurances			$12,000
TOTAL	46		$3,720,720

Although the numbers will vary depending on your location, taxes, inclusion of profits, type of projects and client requirements we get the idea that supporting a staff of fifty people requires well in excess of 4 million dollars in sales each year.

An analysis of the work available within your geographical area will guide you on staff size. Expansion, as you grow, to jobs outside your area will require reanalysis of the plan.

LOCATIONS

Creating a company of more than just a few people requires office space. Locating the right place depends on the industry you serve and the layout of those industries in your area.

Locating in a busy commercial area (shopping centers, medical parks, etc.) creates heavy traffic at some times of the year which your clients will have to negotiate to visit your office. Locations with a lot of heavy industry and industrial traffic can be a problem unless there is an easily accessed route to your office. If a lot of your clients are out of town and expected to visit your office then locations near a major highway and the airport are appropriate.Certain criteria must be met:

Critical

Safety
Accessibility to clients
Size, large enough for the startup period but not too large
Location, ease of finding lunch for employees and office supplies
Adequate parking

Desirable

Short term renewable lease
Surroundings look pleasant
Well maintained structure, clean and rodent free

An office that is obviously too large for your staff looks bad in that it implies poor planning on your part. An engineering office needs to look clean, well-cared for and neat; nobody is really expecting plush carpets and walnut paneling in a startup company.

NAMES AND LOGOS

There are several difficult questions which will have a long term impact on the company's future, two of those are choosing a name and choosing a logo. These may seem trivial but are actually sometimes very difficult to complete. There are companies and web sites which will do both for new companies. Most of these companies do not understand engineering legal matters as they vary state to state and care needs to be taken or money will be wasted with efforts not meeting state Board requirements.

Depending on your state of incorporation the Engineering Board may have a say in your choice of names. More frequently than one would imagine the idea of using your own name as in Joe Blow Engineering Services doesn't work since there are several professional engineers with the name Joe Blow in your state or nearby and the local Boards will not allow company names that are too similar.

Remember that only the initials of your company name may show up on drawings since title blocks are frequently very small. FORD Motor Company serves as an example of what you need to be careful about; the company's name being translated into "Fix OrRepair Daily" and "Found On the Road Dead". Occasionally a company name's initials unintentionally spell a word or a slang expression; "Allison, Smith &Stone Engineering Services" is not likely to be a good choice.

Depending on the area you plan to serve the US is now a multilingual country so your choice of names needs to consider the possibility that the English words used in your name have a different meaning in other languages used by potential clients. Sometimes it is not the formal(English, Spanish, French, etc.) language that misinterprets your name but the local slang. For example "Nova" in French slang can be interpreted to mean "no go", not a good impression for a car or a company.

Look around at some company logos, how many use images with which a large percent of the target population have no connection. Consider those engineering companies using the drafting compass, tee-square and triangle in their logo, since the advent of CAD most engineers do not have experience with these "antique" engineering tools so the logos don't resonate for them.

A web search turns up many books on "logo design". This can become complex involving psychologists and human responses to colors and shapes. The large heavy block letters of the IBM logo are classically considered as strong and masculine. Remember the logo will generally be reproduced in black and white so while the color image may look good the black and white may not have the same impact.

For a small amount of money there are reputable companieswhich will propose several logos along with samples of the logo on business cards and stationary. Usually the simplest design with a minimum of colors is preferable. As expected there is a quantity of "logo design" software offerings available, I strongly suggest some literature research prior to using this approach. A check at the local library will yield some positive results at zero cost.

Logo's can be and perhaps should be copyrighted and again if your design to too similar to another company's the Board may not allow its use.

LEGAL and TAXES

Because this varies state to state and sometimes even involves local governmental bodies we will only briefly touch this complex subject. See Attachment A.

Most states will require that the individual engineer in charge is licensed. For example North Carolina requires that 66.7% of the ownership in an engineering company is licensed in the state. Next door in South Carolina that isn't a requirement. So in South Carolina your non-engineering partner can own and operate the company while in North Carolina they cannot. When you set up the company you need to consider how the company will continue if for some reason the founder and majority owner is disabled to the extent that they cannot actively manage the operations.

Most states will require that the company also have an operating license as an engineering company and if the company operates in a state in which they do not have a full time office at the least they may require a legal representative (usually designated as an "agent") living within their jurisdiction. This individual, where required, is the legal contact for your company in a state where you do work but not a state in which your company was incorporated or has a properly staffed office. This legal contact is meant for the use of the state and local governments and essentially becomes a guaranteed point of contact for the state to use. Legal papers from the state would normally be filed with your agent (subpoenas, overdue tax notices, etc.); contact from your clients does not generally go to this person. The cost of retaining an agent varies from an hourly billing while working to a yearly retainer fee.

Most states in which you operate will require you obtain a company and a personal engineering license in that state for use in stamping drawings of construction to be built in the state. Depending on your state you may be required to have a business license through the labor department as well as local government operating permits for the office or vehicles.

Finally in our brief touch, if you have any employees you may need a tax ID number for any state in which you operate and for sure from the Federal Government and generally in the state of incorporation. This number allows you to pay taxes.

Although rarely used having a lawyer to incorporate your company, help with logo copyright and be prepared to assist in any court cases is a good plan. Generally there is no charge unless he is actively helping although some lawyers will require a yearly retainer fee depending on the expected amount of services.

Attachment A offers some detail on the various types of companies and how they are taxed. The information presented is not sufficient to guide the engineer to the proper choice of company legal shape. For anything more involved than a sole proprietor company it is best to spend a few dollars for some guidance from a lawyer.

AREAS OF SERVICE

Deciding on what areas of engineering you will offer is critical as is knowing where you want the company to be a few years after startup and far into the future. Neglecting to plan for future growth generally means problems later on as the economy changes and the company ages.

If your overall goal is to work as an individual consultant then the planning and legal aspects are simplified. However if you envision a larger more diverse company in the future then detailed planning becomes essential.

If your company begins with just yourself then you may think you can only offer services in your field; Mechanical, Chemical, Electrical, etc. While that approach is probably more common it is certainly not the only path and if your eventual plans include "full services" the following approaches allow your company to take on multiple discipline or large projects while remaining small during its early years.

- Contract with individual consultants for the specialty engineering / design efforts you need
- Contract with another engineering company(s) for the specialty engineering / design efforts you need
- Take the project contract as a "joint venture" with another company or group of individuals
- Obtain the necessary support from a "manpower" supply company, see References.

One large advantage of this approach is that it builds experience with how you and your company react to being larger than it is at that moment. That may seem an inconsequential result but the experience will pay for itself since you can see how the larger company will function without really being the larger company or investing the money to become larger. It allows you to plan with knowledge and some experience in hand.

CLIENTS

There are multiple types of clients:

Local industry	Non profits	Religious centers
Local government	Schools and universities	Startups
State government	Farms	Green industry
Federal government	Utilities	Transportation
Military	Commercial (shopping centers)	

Each of the above operates in a different manner where Requests for Proposals, purchasing, scope of work detail and an understanding of what is actually desired are concerned.

For example:

- An expansion scope of work for a facility in an industrial complex is generally well defined and there are engineering personnel to deal with.
- A similar project at a university will be less well defined and less likely to have personnel available who will understand the design and construction phases of the project.
- A contract with any government body will have hiring rules while mostof industry will not affect your hiring practices.
- Where industry may cite OSHA 1910 for a water treatment facility these rules generally do not apply to government bodies.
- Experience indicates that many government employees have limited experience and place design restrictions in the bid documents which are impractical or ill defined.

These points are presented since they impact the length of time your engineers must spend to understand the scope of work, they also provide an indication of the likely problems your engineers will face with some types of clients,any hiring restrictions may make it difficult for your company to hire the necessary staff.

These differences affect your billing rates and what you would present as a lump sum bid and so must be taken into account when developing your proposal or hourly rates. When dealing with potentially inexperienced clientele the Terms and Conditions in your contract need to explain the need for a proper technical representative and tie down who will be the technical representative for your client.

BILLING RATES

One factor that stops companies from growing or indeed surviving is their billing rate. A mistake in establishing proper and locally appropriate billing rates can stop your company before it starts. These rates are the point at which potential clients can determine what your services will cost them verses the benefits obtained.

There are several types of billing rates depending on how the services offered are contracted and the intended use of the numbers.

Breakeven rate	This is basically a recovery of your costs to do the work and does not include profit but should include administrative expenses and estimated supply costs. This is generally not released to your client.
Hourly rate at client's facility	Because your employees are not in your office consuming office supplies, etcetera, clients may expect this rate to be lower than your standard rate for office work.
Project billing rate	This is the hourly rate charged when you have been awarded a lump sum (for example) contract and is the rate used to determine the lump sum price. This rate is not normally released to the client. Since profit is included as a separate item in the lump sum final cost it is generally not included here.
Non-project work billing rate	This is your "standard" billing rate and includes all costs and profits. Generally used with a new client where no lump sum cost is proposed and when a client calls for a quick engineering solution with no formal scope of work or bidding process.
Out of town billing rate	This hourly rate can contain motel and food expenses or not, depending on the client's desires. Generally the rate may be slightly higher than your standard so a small "in-the-field" increase can be given to you employees.
Travel billing rate	When your employees travel to a job site (as opposed to

	doing the regular 40 hours at the job site) you need to recover the motel, food and vehicle expenses. These amounts are generally a pass through with no profit from them to you; most satisfactory are employee filed expense reports attached to your invoice to the client.
Average Office Billing Rate	When a client contracts for your entire office staff (or a major portion) they frequently want an "average" rate. This can be a difficult calculation and requires an agreement between you and the client as to the makeup of this group.

Many people establish billing rates based on how much money they think they need rather than on how much their work is worth to their potential clients.The proceeding has been underlined since a failure here can be fatal. Frequently they fail to survey the local market for the rates of their competitors. Another error is assuming their rates in an area of heavy industry will apply to an area heavy in textiles, foods or timber. Lastly, areas containing government facilities (ie. NASA) typically accept higher billing rates than non-governmental areas.

Billing rates are generated by including the following:

Individual salaries plus costs of
- Vacation coverage
- Sick time coverage
- Bonuses
- Projected non-working hours

Taxes on salaries (FICA, unemployment, etc.)
Tax preparation (accountant)
Business licenses
- Local
- State(s)
- Federal
- Engineering Boards

Cost of support for employees
- Equipment Amortization
- Internet
- Telephone
- Travel

Facility costs
- Rent
- Building insurance
- Electrical supply
- Heat
- Security
- Office supplies

Insurance
- Unemployment

Liability
Umbrella
Vehicle and equipment
Health
Workmen's Compensation
Errors and Omissions
Owner's life insurance

Cost of lawyers / agents if applicable
Local effects
Safety training at the client's site
Special safety equipment for your personnel
Interest on loans (see Getting Paid)
Contingency to pay employees to correct work errors
Profit (places last since it is frequently a percent of total costs)

Typical much simplified billing rate calculations follow based on the details in the tables below. No amount is included for corporate income taxes as this varies state to state and on the type of incorporation taken, see Attachment A. Depending on the location various costs will be considerably higher or lower; either way the concept is the same. The contingency is usually taken on the final numbers as rents, electricity, etc. frequently go up during a long term project; the contingency provides funds for corrections to the design if needed. The contingency should not exceed about 10% if the scope is well defined. Contingencies may or may not be released to the client; on occasion all or part of an unused contingency may be deducted from the final invoice for a lump sum contract for a particularly good client.

Single Individual Billing Rate Sample

We'll calculate a workable billing rate for a company owned and staffed by a single individual. Because taxes vary from state to state and the type of incorporation involved we'll leave these out of this math. For some of the same reasons FICA is also left out of this math. But in the real world in your state you need to include them in some manner. Profit is set at 5% of total sales which will be simply hours worked times billing rate for the one person in the company. The basis is 2080 hours per year billable.

Employee	Description	Hourly Cost	Yearly Cost
Owner	Working engineer	$60	$124,800
Rent	$500/month	$2.88	$6000.00
Heat / AC	$140/month	$0.81	$1,680
Electrical	$135/month	$0.78	$1,620
State / Fed Licenses	$500/year	$0.24	$500
Office Supplies	$300/year	$0.14	$300
Internet	$90/month	$0.52	$1,080
Liability, Errors and Omissions, etc. insurances	$4,000/year	$1.92	$4,000
TOTALS		$67.29	$139,980

PROFIT, 5%		$3.36	$6,999
BILLING RATE		$70.63	$146,979

The owner can review and adjust the figures depending on client and project work load; because he is paying himself $60 an hour he may delete the 5% profit to be somewhat more competitive. In this case the owner only reports to himself or herself and does not need to explain the cost figures to a Board of Directors or stock holders.

Multiple Staff Billing Rate

For this exercise we'll assume that all the engineers and designers are active on the project, three (3) employees. The goal is to determine what the billing rate should be for each person. The secretary represents a critical person since she / he is not billable to the work but needs to be paid anyway. Remember that all of the company staff gets a pay check whether or not they are doing billable work. The secretary falls into the fixed costs column and is treated in the same manner as the electric bill or heating bill. The salesman also is a fixed cost and not billable.

We'll assume four (4) weeks (one work month or 160 hours each employee) work for each billable individual.

Employee	Description	Hourly Cost	Hours per Year	Project cost for 160 hours
President	Working engineer	$60	2080	$9,600
Engineer	Working engineer	$45	2080	$7,200
Designer	Design / Field work	$30	2080	$1,800
Sales	Part time salesman	$40	1040	$3,200
Secretary clerical	Secretarial, billing, accounting, payroll	$20	2080	$3,200
FICA	Est. 7.5%	$12.88		$1,875
Unemployment Ins.	Est. 1%	$1.74		$250
Rent	$500/month	$2.88		$460.80
Heat / AC	$140/month	$0.81		$129.60
Electrical	$135/month	$0.78		$124.80
State / Fed Licenses	$500/year	$0.24		$38.40
Office Supplies	$300/year	$0.14		$22.40
Internet	$90/month	$0.52		$83.20
Liability, Errors and Omissions, etc. insurances	$4,000/year	$1.92		
TOTALS		$174.90		$27,984

This number [$174.90] can be used several ways and has some significant value to the owner; with this number in hand a lump sum cost can be developed. That assumes that all the employees are full time on the project. By weighting the numbers we can find a suitable billing rate for each billable person. Weighting is done as follows: Hourly Cost/Total Hourly for the billable

employees times Total Calculated Hourly cost [$60/$135]x[$174.90].Individual rates then become:

Position	Billing rate
President	$77.73
Engineer	$58.30
Designer	$38.87

That's a nice rate but is only the break even rate and includes no profit for the company nor the effects of income taxes.

There are several methods to calculate similar costs giving slightly different results and as long as all cost factors are included the method used is not necessarily critical.

GETTING PAID

Obviously the goal of this company creation is to earn money for the company and for what would appear to be a simple action several things can go wrong here and create problems.

People generally pay their bills when they come due; but not always. The same happens with your invoice to your clients. Some pay right on time but many will drag out an agreed to 30 days for payment to 45 or more days. It is quite acceptable to add a percentage to the invoice amount based on when it is paid, collecting that interest is another thing altogether.

Agreement to the Terms and Conditions (TnC's) on the purchase order gives you the best protection and allows you to adjust your billing rate to cover the extra time it may take for you to receive payment. Most client TnC's will detail when payment will be made and how often it will be made.

Once you feel comfortable that payment of your invoices will occur at a specific time after the invoice is issued you can determine if you will have the necessary capital on hand to make your payroll until the check comes in to your bank. Otherwise you may need a loan. Be very careful about letting a major client go too long on overdue payments, you can make a lot of money on paper and fail as a company because your employees left for a job where they can get paid.

The larger your client's company is the more difficult they seem to become when it comes to paying your bills. An upfront agreement between you and the client's engineer frequently means nothing to Purchasing or Accountants Payable. Again your best protection is the Terms and Conditions.

Stopping work on a project because of overdue invoices can be done but ONLY after discussions with your contacts at the clients. Resorting to your lawyer to collect past due amounts is one of the last actions you want to take and generally means the loss of the client.

When the client changes the Scope of Work then you need a change order with client approval, Except in excellent circumstances you do not want to take a "verbal" change notice. Any change

order submitted tothe client needs to have a dollar amount attached to it and a notice of the additional time for completion of the change.

RATE OF GROWTH

For a very small company (perhaps 5 or less people) a single job may require a doubling of the staff. Although that sounds positive for a startup company there are some hidden traps which must be considered:

Once the new staff is on the payroll do we have enough work to keep them busy? Having personnel on the active payroll but not involved with paying work is damaging to the finances as well as morale. Most projects have some inactive periods within them for some portions of the engineering / design team so before hiring more employees care needs to be taken that most of their time is paid for by chargeable work. For this reason it is good practice to take a large number of small projects as opposed to one all-consuming large project.

When expanding the staff a similar problem to the above occurs when adding a specialty engineer or designer. For example hiring an engineer whose experience limits him / her to work on rainwater runoff control makes finding paying work for that individual difficult for the sales effort.

ADVERTISING

Until recently in many states engineers were not allowed to advertise their services and even today it is fairly rare. The first thing to do is determine if you are legally allowed to advertise in your state. Public advertising probably doesn't reach most of your potential clients but specific approaches offer direct exposure to them:

Mailed brochures
Letters to individuals within the potential client's organization
Email letters to the purchasing departments of potential clients
Recommendations from individual clients to other potential clients
Recommendations from construction firms with whom you've dealt
Recommendations from equipment suppliers with whom you've dealt
Area engineering association meetings
Area manufacturing association meetings
Yearly sales / seminar events (Powder Handling Show, etc.)

Business cards, brochures, calendars and handouts are generally expected "advertisements" when you make sales calls. The best handouts are those which stay on top of the engineer's desk; items like Glover's "Pocket Ref." (see References) are useful for quick references and are usually appreciated by the technical people. Even with your company name imprinted on the cover these and similar items are relatively inexpensive and effective reminders that your company exists.

SALES

Sales and Advertising have the same goal, gaining work, but are different approaches. Sales are generally done by individuals working from your company and include door to door and cold call approaches.

Additional efforts on your behalf can be had through local equipment suppliers, construction companies and existing satisfied clients. Before listing a past client as a reference try to get their approval and some feel for whether or not their reference will be positive. Remember too many calls to one previous client may become an irritant to him / her and result in a less than positive reference. Where you had particularly successful project with a client asking for a letter recommendation that you can send to potential clients is better than having your client receive numerous phone calls.

Choice of the sales person is tricky. While doing sales for one of the companies I worked for my company was complimented because they had sent the client an engineer capable of actually doing the work as the salesman. The implication of the compliment was that if the salesman could do the work himself then obviously the company he represented could do the work. That is not necessarily an inexpensive approach but using a retired engineer to work as a part time salesman could be beneficial. An experienced salesman with some engineering background could likewise be beneficial. Nothing damages a sales effort as quickly as the salesman not knowing his product.

Depending on the client calls to engineering staff are usually more effective than calls to purchasing departments.

TERMS AND CONDITIONS

Terms and Conditions (TnC's) cover a wide range of items and are usually an attachment to purchase orders and contracts some of which are listed below (check the flow directions of the TnC's). These items are frequently also referred to as "boiler plate" and generally constitute a listing of rules and regulations under which the work will be done. Frequently they are written for construction forces but you need to review them in case they impact your activities and costs. When you accept a PO (purchase order) from a client you are agreeing to all of the TnC's listed on the PO. You can take exception to some TnC but with larger corporations this rarely has any effect.

From your client to you

Required insurances
Working hours
Safety training
Accident reporting
Vehicle parking
In plant traffic
Hot work and vessel entry permits, power interruptions etc.

From you to your client which is not the common path and may or may not be accepted by the client.

Work area conditions
Technical support
Safety arrangement
Equipment receiving and off loading
Work area telephones, internet, company intranet
Vehicle parking

This is one spot where having your lawyer review a contract may be worth the cost, in particular if this is a new and large corporate client. Because they vary widely depending on industry, company and location it is critical to review these items and failure to do so will cause you problems.

CONTRACTS and PURCHASE ORDERS

Contracts can be as simple as a hand shake or as complex as a multiple page lawyer prepared document. The first costs nothing but the cost of the second needs to be incorporated into the contract price as it can be several thousand dollars. There are standardized contracts available from a variety of sources, most are fairly expensive if they are good.

Purchase orders issued by the client AND accepted by your company are a simple and commonly used approach to the contract. The more often your company works for a client the more frequently you can both benefit from this simple and inexpensive contract format. Acceptance of a purchase order by your company generally means you have accepted his working conditions, amount of money to be paid for the work to be done, insurance requirements, schedule, quality of the work, scope of work, TnC's, etc. It is critical you understand these factors prior to accepting the PO.

Almost any bank will make a loan on a written contract if their research indicates both companies have a history of following through on contracts, this can become expensive but also provides a way to obtain funds early in a project to assist with startup.

At a minimum the contract, verbal or written, needs to contain an agreement on the following items:

- Scope of Work
  - Type of software to be used (Windows, CAD, Calculations)
  - Client approvals of the scope
- Where the work is to be done (your offices or the client's facility)
- Whether the work will be accomplished on an hourly charge basis or as a lump sum contract
- Billing rates or lump sum price
- Payment terms, 30 days, 45 days, specific progress points (foundations, structure, equipment, etc.) etc.

- Any hold back on pay until completion (usually less than 10%)
- Travel reimbursement details
- Starting and completion dates
- Determination of successful completion of the work
- Who will inspect fabricated equipment
- Contact information in both companies both for technical and other activities
- Contract termination arrangements for each company
- How scope changes and resulting costs if any are to be handled
- Procedures for resolving project cost overruns
- Depending on your relationship with the client and the size of the scope of work
    - Dispute resolution technique to be used
    - Amounts and types of insurance you will need to carry for the project
- Your deliverables
    - Drawings (hard and electronic)
    - Specifications
    - Calculations
    - Inspection reports
    - Purchasing

It is critical that all agree on the type of contract to be used. There are probably twenty different types of contracts (see References) but several commonly used bid types to be considered are given below, the definitions used for each must be agreed to by both parties:

Hourly rate	The simplest type requiring approval of time cards for each employee on the project. Billing rates to be established at contract acceptance.
Lump sum	A proposal to do the work for a single stated dollar amount with no submittals of time cards or other evidence of who or what work is being done.
Lump sum not to exceed	The same as above but with an upper limit which means the scope of work must be carefully agreed upon as well as the schedule. Scope growth must be limited and controlled by changes orders requiring dollar amounts and time required approved by both parties.
Cost reimbursement	A simple process where total costs for your work are paid and include your profit plus markup on materials you purchase.
Cost plus incentive	Essentially the same as above but with an incentive usually tied to schedule or overall costs of the project.
Lump sum plus incentive	The same as Lump Sum above but with the incentive attached.

The use of incentive contracts is fairly common and offers some benefits to both parties. Generally the work goes faster and at well controlled costs and when the incentive is paid the total costs is frequently less than the original lump sum might have indicated. Incentives vary up to about 15% of costs. Usually the incentive to be paid is negotiated or decided solely by the client.

WEB SITES

Today's companies commonly use web sites to improve their exposure in the business world. These relatively inexpensive advertisements allow for significant information about the company to be presented in a beneficial light. Normally the web site contains a listing of the company's services, a listing of employees, contact information, samples of work completed, a list of client references and resumes of employees. The addition of a place for site viewers to send in Requests for a Quote and ask questions is usually beneficial.

Creation of the web site can be contracted or employees working on projects that have some non-billable time can create the site with the help of multiple software offerings designed specifically to help design web sites. This approach usually helps build employee morale and a sense of ownership in the new company.

The disadvantages to a web site are few butit is critical to understand that most sites require employee monitoring especially if the site allows for comments or questions to be posted. Failure to respond to these can offset any benefits gained. Frequent updates are usually beneficial and do not take an inordinate amount of time.

Any time that a previous client is listed and in particular if photos of the completed work are to be included in the web site specific approval should be obtained in writing before proceeding.

ACCEPTING AND REJECTING WORK

For a new company the concept of rejecting any work appears to be in conflict with being in a startup position; however, the decision to reject work that you could gain is one of the most critical points in a new company's life.

Several questions need to be answered each time a new opportunity for work appears.

1. Do the technical aspects of the work match our capabilities?
    a. If not can we use a part time employee to fill the gap?
2. Will this one job occupy so much of our effort that existing customer relations will suffer?
3. Will taking on this effort force us to hire additional employees before we are ready to expand?
4. If we must hire additional help do we have the necessary equipment and physical space for them?
5. If this work must be done at the client's facility will that mean our office will be un-staffed with technical people if another client calls with a problem?
6. Will taking on this job cause our company to appear to be specializing in one industry?
7. Is the dollar value of the job within the limits of our insurance (liability, etc.)?
8. What is the impact, if any, of the size of this job on our insurance policies? Are the insurance dollar amounts sufficient to cover the most likely problems?
9. Can we do this job and enjoy the work?

Occasionally a company will accept work at almost no profit just so they don't need to lay off employees, this approach has some value even with no profit since you are adding to the company resume and holding onto your staff. You obviously cannot continue forever with this approach but with careful management these projects can carry the company through rough times.

PRODUCTION

Once the Scope of Work is approved the actual project work can begin. Coupled with your deliverables list and the time line for the work you now have enough information to establish a work plan.

This needs to be considered carefully and any potential project schedule upsets listed along with the solution; where there is no solution it is time to go back and discuss with the client. Worse than "crying wolf" is not telling the client upfront about problems. Part of the goal is to establish a "team" between your company and the client's staff.

Transmittals of completed work are important records in particular if there are specific time line points to be met by the project. For example if the foundation drawings are due on a particular date the formal transmittal of the design with file copies is your legal proof of on time delivery.

It is also important that the client's representative sign off as receiving the drawings and design and if he / she is qualified signing off on the submitted design. The signature on an engineering drawing by the client's purchasing agent generally only means the drawings were received on a specific date but do not generally represent technical acceptance of the design. The technical sign off person for the client must be established during the contract process.

EMPLOYEES OR NOT

Although you may own the company, when it exceeds a certain size, as determined by state and federal regulations, you may be required to hire individuals based on a variety of non-engineering characteristics. This requires a thorough understanding of EEOC, ADA and other rules and regulations plus perhaps some local and state rules. This one item means you need to think about company size and even the clients you would like to approach. This is frequently a problem when taking federal government work or even when taking work for a company which is doing federal government work.

Because the company staffing is dependent on the project work load you may have to consider other than full time employees to avoid some of the problems created by the restrictions of the EEOC rules. Frequently the local department of labor, sometimes the interpreter of EEOC rules, does not recognize the difference between a graduate in engineering and a professional engineer.

There are several generally used methods of employing additional help for small companies for short work overloads:

1. Part time employees (usually less than 30 hours a week)

2. Contract or 1099 employees
3. Contract individuals for specific portions of a project from other companies
4. Short term hires but full time employees with their agreement up front
5. Regular full time employees
6. Manpower supply companies
7. Local labor departments
8. Local community college students

Remember that adding employees means you are taking on some financial responsibility to keep them employed, destruction of company morale is something to be avoided so expanding slowly under good conditions is critical. Hiring employees on a probationary period is frequently a good plan as both the employee and company get a trial period with easier termination if needed.

Selecting employees whose character matches your view of the company's character is critical to your efforts. If you have taken on employees whose character and work quality do not match your own then you will find yourself spending time correcting things rather than growing the company.

INSURANCE

Most small companies need some form of insurance and what is required may vary somewhat from state to state. Because of this variability and the potential losses when improperly insured the owner should consult an insurance agent(s) with a strong professional insurance background. Your brother-in-laws home owner's insurance company is not the choice you need for engineering insurance and is one family pressure you need to avoid.

- Some types of insurance are required by law: Unemployment insurance, Workers' compensation, Vehicle and Equipment
- Some types will be required by the client's purchasing department: Liability insurance, Professional liability insurance, Errors and Omissions
- Some types of insurance are required by conditions within the company and company size (both number of employees and dollars of sales): Umbrella insurance, Owner's / CEO's life insurance

The following are some of the more common insurances you may need. Occasionally the client will request a completion bond and while not insurance it represents a cost to be included in your billing rates and is frequently available through insurance companies.

1. **Liability insurance** is a part of the general insurance system of risk financing to protect the purchaser (the "insured") from the risks of liabilities imposed by lawsuits and similar claims. It protects the insured in the event he or she is sued for claims that come within the coverage of the insurance policy.
2. **Professional liability insurance** (**PLI**), also called **professional indemnity insurance** (**PII**) but more commonly known as **errors & omissions** (**E&O**) in the US, is a form of liability insurance that helps protect professional advice- and service-providing

individuals and companies from bearing the full cost of defending against a negligence claim made by a client, and damages awarded in such a civil lawsuit.

3. **Unemployment benefits** are payments made by the state or other authorized bodies to unemployed people. Benefits may be based on a compulsory para-governmental insurance system. Depending on the jurisdiction and the status of the person, those sums may be small, covering only basic needs (thus a form of basic welfare), or may compensate the lost time proportionally to the previous earned salary.
4. **Workers' compensation** is a form of insurance providing wage replacement and medical benefits to employees injured in the course of employment in exchange for mandatory relinquishment of the employee's right to sue his or her employer for the tort of negligence.
5. **Umbrella insurance** refers to a liabilityinsurance policy that protects the assets and future income of the policyholder above and beyond the standard limits on their primary policies. Typically, an umbrella policy is pure liability coverage over and above the coverage afforded by the regular policy, and is sold in increments of one million dollars. The term "umbrella" is used because it covers liability claims from all policies underneath it, such as auto insurance and homeowners insurance policies.
6. **Owner's / CEO's life insurance** This is protection for the company in the event the owner dies leaving company debts which might go to his estate and to provide for interim pay to a manager to develop a continuance plan or shut down plan for the company.
7. **Vehicle and equipment** Similar to your auto insurance covering accidents, theft and may include loss of use or replacement and some liability
8. **Health** Employee health insurance, voluntary in most states.

Certain policies can be purchased on a project by project basis. For example there is little need to carry a multi-million dollar liability policy when the maximum exposure (based on project dollar amount) is only a few hundred thousand dollars. The face value of this policy can be adjusted as individual projects of larger values are taken.

An insurance review is necessary with each new client and anytime the project value from an existing client increases significantly.

It is critical that the engineer review with the client's purchasing department the insurance requirements attached to any purchase order.

Some insurance decisions must be discussed with the agent:

- If employees drive to the client's facility in their personal vehicles whose insurance (company vs. employee) covers the vehicle in case of damage?
- When an employee is assigned to a client facility in a different jurisdiction for a long period of time how does this impact workman's compensation insurance?

If the new company is to offer services in multiple states at a minimum the liability insurances need to be purchased so they apply in all active states. If employees are to be placed at a client's facility in another state for an extended period of time the workman's compensation insurance

may have to be purchased in that state. If an office with staff is opened in another state all insurances must be active in that state which may mean multiple agents.

ACCOUNTING SUPPORT

The need for accounting support is related to the various taxes due to Federal, state and local authorities and depending on the type of incorporation selected tax preparation can become quite complicated.

There are various levels of accounting support suitable to small companies including full services, payroll, taxes only and use of existing software. Because of the related income tax issues having an accountant prepare taxes for companies other than simple one man consultancy is worth the cost.

A good clerical assistant can maintain sufficient bookkeeping to handle profit and loss monthly details, payroll and invoicing. Payroll is frequently passed to a payroll service such as ADP (Automatic Data Processing, Inc.) among many others. The cost is low for the insurance insuring deductions and checks are properly handled on time.

PROBLEMS

The biggest danger from problems with clients is not the problem itself but the failure to address the problem.

Accepting the fact that at some time the design produced will not satisfy the client is the practical approach to operating a company; what you do about it is more important than anything management needs to work on. One reference stating “they failed to respond to my complaint” can destroy an image built on many years of excellent work.

Most companies expect minor problems and the longer your company works with a specific client the easier it usually is for them to accept minor errors on your part. What most companies will not accept is a failure on your part to address the problem, and sometimes engineering companies refuse to even acknowledge a problem exists.

Having the contractual framework in place that allows you to ignore the client’s complaint is not protection from the damage this can cause.

Okay, I’ve stated the problem four times to highlight the importance of preparation for and action on your part when a problem arises.

Let’s look at a simple example.

Joe Blow Engineering Services has taken a contract with a new client, ABC Chemicals, to build a new tank truck loading station. The design is complete and specifications have been prepared for equipment and piping to be purchased, no purchases have been made yet. Client approval signatures appear on the drawings (Critical).

Joe's chief engineer has mistakenly sized the truck loading pump for 50 gallons per minute whereas the scope of work calls for 75 gpm. When the client's engineer tells Joe's engineer about the error the response is "You approved the design as issued."

The amount of effort required to correct the problem is minimal

- Resize the pump and determine new horsepower
- Check and resize the pipe if necessary
- Check and resize the electrical power feeds if necessary
- Revise drawings
- Verify that the new pump will fit in the space allocated for the original pump
- Meet with client's engineer to review the revised design

The potential damage caused by Joe's engineer could be widespread

- Client immediately cancels the contract
- Client cancels plans to issue additional contracts to Joe Blow Engineering Services
- Client slowly spreads the word about the poor response from Joe's engineer
- Client may initiate a claim against Joe's errors and omissions insurance
- Client may issue a complaint to the local BBB
- Client may issue a complaint to the state engineering board

It is doubtful that Joe will lose money by making the corrections and the client may even be willing to split the cost of corrections since his engineer also missed the error when he approved the design. Joe's initial contract price or billing rate should include some contingency to cover minor costs such as this. Failure to respond to the client's complaint will most certainly cost Joe more than the cost of corrections.

Most of the time preserving client relationships is worth more than being legally correct in refusing to correct an error. The money spent can usually be recovered by a small increase in pricing for future work from this client.

More problems for a company usually come from employees than from clients.

A lot of these problems can be avoided by carefully selecting employees and even part time support personnel.

It is not the intent of this paper to offer employee relations guidance, that is better left to professionals and has been covered by many authors.

REFERENCES

- Most community colleges offer some range of business courses and perhaps even a "start your own Business" course. Either way technical assistance for start up companies is frequently available.

- Another good source is the SBA (Small Business Administration) where you can usually find older individuals with experience in starting and running companies. Be careful as some of these people are just looking for an audience and offerminimal help. My experience is that their efforts are generally not aimed at engineers but their input on taxes and legal matters is still applicable.

- Sources of support manpower like Manpower, Inc. abound throughout the US and generally in the larger metro areas can provide engineers and designers. Care must be taken with the type of contract you put in place. You also have to be very specific on the types of engineering expertise you're seeking; for many of these companies all engineers are the same; interviews are critical here and must be well documented in case you reject the individual they send you.

- To see the range of contract types go to the following site "Part 16 Federal Acquisition Regulation (FAR) at http "acquisition.gov". Obviously this listing is for contracting with the government but the listing is beneficial and provides sufficient detail of the contract type to allow selection of the proper type for an engineering company.

- Thomas J. Glover Pocket Ref.
  Sequoia Publishing, Inc.
  P.O. Box 620820, Dept. 101
  Littleton, Colorado 80162-0820
  ISBN 1-885071-33-7

- ATTACHMENT A
  Incorporating Your Business
  Tax Factors to Consider
  By William Perez, at About.com

CONCLUSIONS

The potentials of owning and operating your own company are many and because of the wide range of forms the company can take there will be opportunities matching most engineer's interests. The thrill of growing a company from startup to a stable entity is available to most professional engineers with minimal effort and capital outlay.

Dissatisfaction with large corporate engineering offices and policies is replaced with simplified policies readily changed by the owner. Difficult individuals withinclient organizations do not need to be dealt with when you can make your own choices. Individuals hired by your company can be selected to match your own character as opposed to the desires of someone in Human Resources.

Developing the company along the lines you desire can allow you to choose the types of work you want and what part of the actual engineering effort you want to take part in for yourself. It is also fun if you will let it be.