

Engineering Operations Strategies

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Congratulations!!

Welcome to *Engineering Operations Strategies*, your do-it-yourself guide to creating an Operations Plan that works for your engineering firm.

Once you've been through this guide, you'll know precisely what it takes to write an effective Engineering Operations Plan and supporting documentation. More importantly, you'll have a sample of a powerful Operations Plan to get you started.

This is the next step in your business story. From this point on, you won't have to stab in the dark – you'll have clear direction. You'll start to see some real results for your efforts.

Once completing the on-line course at our web-site www.engineeringbusinesspubs.com, you will be awarded with 7 PDH. The on-line seminar includes reading this guide and passing three tests on our web-site.

Currently 30 U.S States require licensed engineers to obtain continuing education credits (CEU) or professional development hours (PDH) in order to renew their license. The PDH awarded by our seminar will be accepted by your state licensing board. **I personally guarantee it.** If your state board rejects our on-line seminar PDH, please forward us a copy of the board's letter and we will refund to you the cost of the on-line seminar.

How to Use this Guide

Each step covers an important aspect of your Operations Plan – these are things that you must give special consideration to before implementing your Operations Plan.

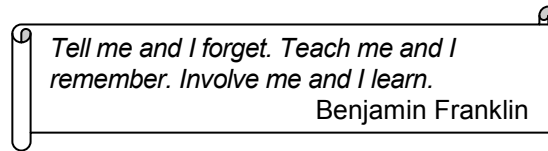
You will be surprised how much this guide will reveal about your business. It will get you to think about important issues that may have never crossed your mind in the past. It may also uncover new issues. But it is never a better time to put together or update your Engineering Operations Plan than now.

While reading please go ahead and jot down some notes in the spaces provided. It will help to improve your Engineering Operations Plan.

Later sections will go into greater depth describing the Standard Operating Procedures, Quality Control and Quality Assurance, and Checklists.

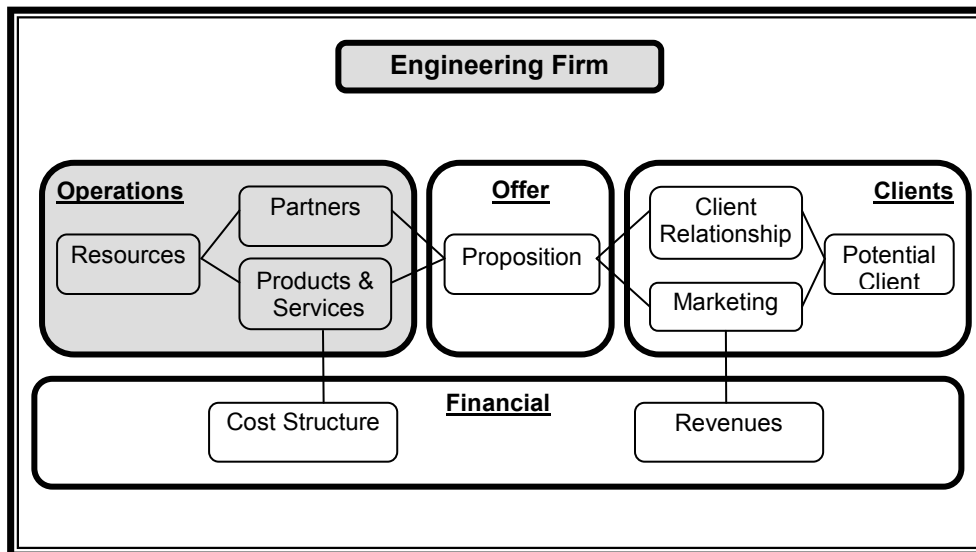
Now, it's time to get started.

Engineering Business Operations



The Engineering Business structure can be described as four components consisting of Operations, Financials, Clients, and the Offer. A diagram of the connection between these individual components was further discussed in the *Engineering Business Plan* guide. The guide can be found on our website www.engineeringbusinesspubs.com. That diagram is redrawn in the Figure below.

Figure 1 – Engineering Business Model with its Components

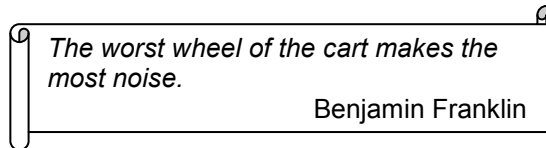


This guide discusses the Operations Component which consists of the Resources, Partners, and Products and Services.

What are successful Engineering Operations Strategies?

Operations strategies are influenced by the nature of the goods and services to be produced or provided and the markets to be served. Applying the correct strategies greatly increases the opportunities for success in various economic conditions. Some strategies work better in poor market conditions while other strategies work better in good economic conditions. The operation plan implemented can lay the ground work to a company's success or failure.

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Operation Strategies implemented depend on whether the company is product-oriented or service-oriented. More and more companies in the United States are service-oriented, which is defined as being 50 percent or more of the company's business activities are service related. The product-oriented (goods-producing) companies consisting of manufacturing, construction, and extractive industries such as agriculture, mining, forestry, and fishing have fallen from more than two-thirds of the United States economy in the early 1900s to about a third in the early 2000s. Service-oriented companies in the same period have seen a significant rise in the percent of the economy. These service-oriented companies can be categorized into several groups:

- Business services – consulting, banking, and financial services;
- Trade services – retailing, maintenance, and repair; social/personal services such as restaurants and healthcare;
- Public services – government and education; infrastructure services such as transportation and communication; and
- Professional services – lawyers, doctors, accountants, architects, and engineers.

Service Companies can also be divided by the intensity of labor and customer customization. Service companies slide up and down on these scales. Even within the Professional Service sector different types of businesses tend to be placed higher or lower within these categories, but in general they are high on labor requirements and job customization. Engineering firms are extremely labor intensive and customized for each client (no two projects are the same). Although engineering firms do produce products (plans, reports, construction estimates), the firms are almost entirely service providers. Professional engineering designs are based the company's experience, technical knowledge, and expertise. In addition, each job is specific to that client and project. Even if the client has a business plan for 15 new auto parts store in the same community, each project site will present its own set of conditions and complications that will need to be designed separately by the engineering firm(s).

The success of the engineering company's ability to provide the client with a well designed project depends on the operations of the firm. The firm's Operation Plan establishes these procedures that the staff will follow to create the end product or service for the client.

Let's now discuss the Operation Plan.

The Operation Plan

The Operations Plans for a Professional Service Business like engineering is quite a bit simpler than for other forms of businesses like retail and manufacturing. But not all engineering businesses require the same level of complexity (See the attached Sample Operation Plan). The main brunt of the plan is to describe to your reader how you will deliver the end product to your client from the beginning to the end.

The Operation Plans for businesses that bundle together products and services should consist of the following key elements:

- **Task Responsibility** – Everyone has specific tasks and responsibilities to perform within the engineering company. It is necessary to specifically state who is responsible for each of those tasks. Without this being stated various tasks may be overlooked or even duplicated by several individuals. In either case the operational efficiency of the firm is significantly reduced.
- **Business Physical Setup** – Some engineering firms prefer the pit layout as the most efficient setup for the office. This physical layout is generally described as an open area with the CAD operators and designers, and around this area are the offices for the engineers and project managers. Some firms prefer an open floor plan where everyone is visible. Some prefer the cubical maze, and some prefer the small offices for two to three work stations. Whatever style your firm uses should be explained and how it supports the operation and strategy of the firm.
- **Inventory** – In order for an engineering firm to provide the services required by its clients, the firm must have sufficient equipment, resources, and software to provide the latest technical advice and expertise to its clients. A detail list of all equipment including desks, chairs, and computers; reference materials including International, Federal, State and local standards; software manuals; and all software, is necessary to determine what material needs to be updated or even obtain to provide the client with the latest information and technology.
- **Manufacturing** – Although engineering firms do not generally manufacture any particular product, they produce publications such as letters, technical reports, technical specifications, and plan sets. It is necessary for the firm to set out explicit details on the format of these products. This is not only important to the marketing efforts of the firm, but also the quality of the firm's products.
- **Safety Protocol** – Well there are not many safety precautions within the office, engineers are required to visit the job site before, during, and after construction. During these times it is necessary for the staff to follow safety precautions to avoid injury and property damage. This is necessary for not only the engineering firm, but

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also the client. You don't want the client to see your staff as a major liability on the job site.

- **Outsourcing** – Most engineering firms are not large enough to provide the entire services ancillary to their specific field. These areas are usually subcontracted out to other firms. This outsourcing actually improves the firm's financial budgets. Services that may be subcontracted out are not only technical like structural, geotechnical and traffic reports, but also administrative tasks like accounting, and printing and reproduction. These tasks are usually subcontracted because there is not enough workload in those areas to make it economically feasible to have in-house. Although these services may be sub-contracted out, the completed products and services must meet your company's standards.
- **Quality Control and Quality Assurance** – Although every project is different the products produced by the engineering company should have some consistency to reduce comments from reviewing agencies and costs to the client. In the Operations Plan describe what methods you are using to ensure a quality set of plans, reports, or other products. (See the section later on in this guide.)

Now it's time to take a look at your engineering business. Please take some time to jot down some notes in the spaces below.

Please list your company's employees and describe their responsibilities (If your company is larger then 25 individuals, you may want to list departments and their responsibilities instead of individuals)

Name:

Responsibility:

Name:

Responsibility:

Name:

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Responsibility:

(You may need to continue this on separate sheets of paper)

What is the physical sit-up of your business? If you have several branch offices, then what is the typical sit-up? Pit Cubicles Individual Offices Other

Please show layout, and explain why this sit-up is best for your business.

Next is the company's inventory:

List the all of the company's equipment including desks, chairs, and computer

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Now the manufacturing lists

List the types of documents issued by the company including letters, reports, specifications, plans, and maps.

Does Your Firm have a safety Protocol document that the staff is to follow in and out of the office? Yes No

If yes, is the staff required to read and sign at least once a year? Yes No

What company services are outsourced or sub-contracted?

What Quality Control and Quality Assurance methods is your using?

This is the beginning of the Operation Plan. Now take your notes above and formalize your plan.

Review the Sample Operations Plan at the end of this guide and your notes above to create your own plan.

Now let's review a graphical representation of the Operating Plan.

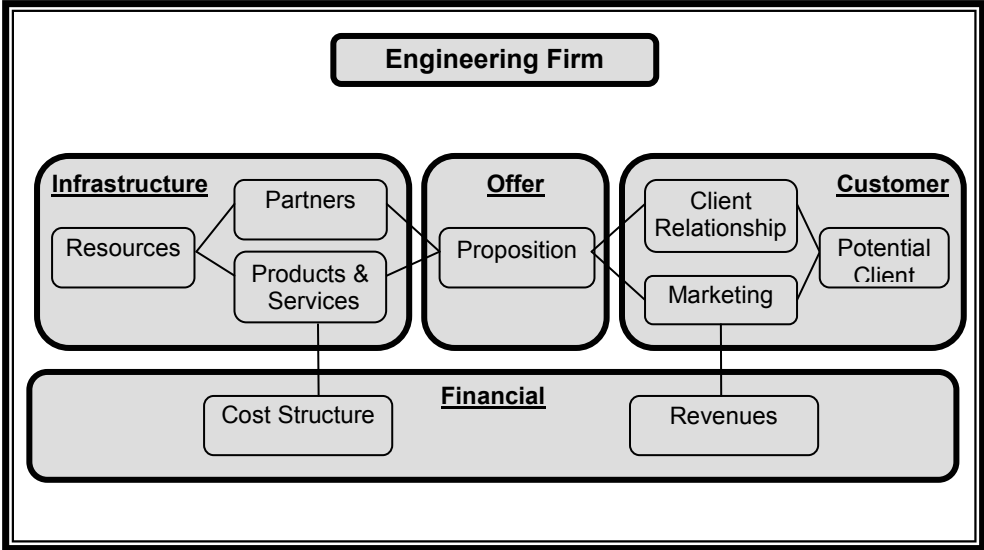
Operating Business Model

The Operating Business Model or Business Model is a graphical representation of the business. The Business Model deals specifically with how the business gets the product or service to the client. The Business Model is the organization's essential logic for consistently achieving its principle objectives. The desired outcome is to have a "road map" to carry out the Operations Plan. The key elements of the plan are as follows:

- Products and Services offered to the client
- How these Products and Services attract the client

Although not all models are the same, an engineering company's business model is usually similar to the one shown in Figure 2.

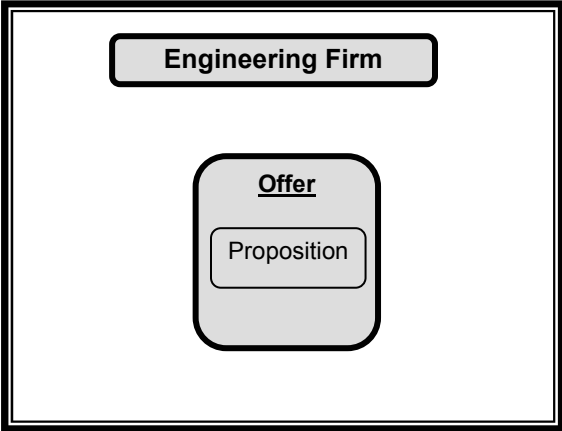
Figure 2 - Operational Business Model



Now, let's break the business model down to how a typical engineering company operates as follows:

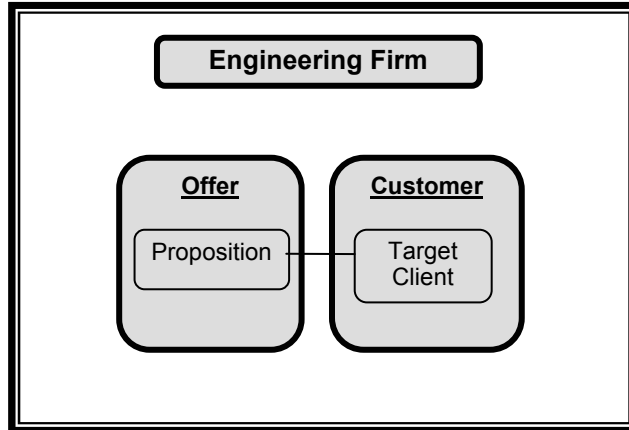
- **Proposal** – How does your company prepare and make the offer to the client. (Figure 3) This is also known as the Proposition.

Figure 3 – The Offer



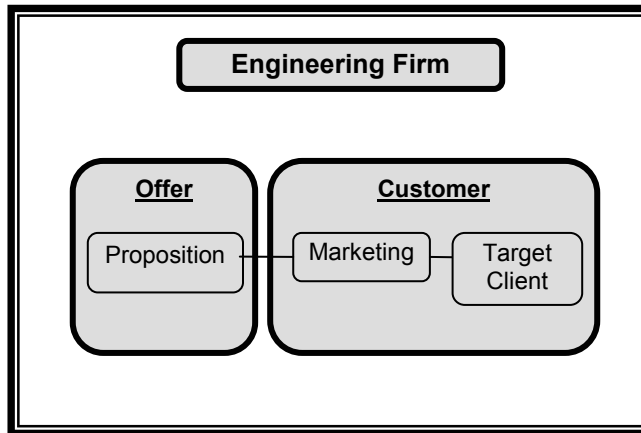
- **Target Client** - Who is your company's target client? If you are a small company you may want target the smaller developers or you may want to partner with a larger firm to attract government contracts. (Figure 4) You will want to present your proposal to as many targeted clients as possible.

Figure 4 – Who the Company Makes the Offer To



- **Marketing** – Depending on who is your targeted client, how does your firm adjust its marketing to reach those clients? (Figure 5) In order to get your proposal to as many target clients as possible your will have to market the group so that they will want to see your proposal.

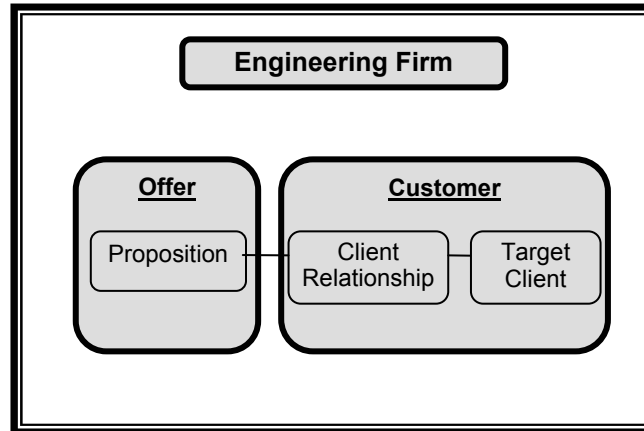
Figure 5 – How the Company Gets to the Client



- **Loyalty** – Once the company has gained a client, what does it do to keep those clients? How does your company build client loyalty? (Figure 6) There are other

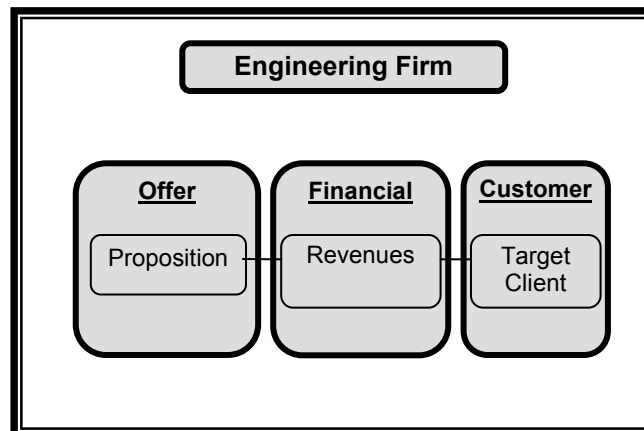
companies trying to catch the attention of your clients. You must keep your clients satisfied with your services by building a solid business relationship.

Figure 6 – The Company Builds a Relationship with the Client



- **Cash Flow** – Most engineering companies generate revenues by receiving payments on monthly invoices from the client. How does your company make money? (Figure 7) The quicker a client pays on the invoices the greater your firm's cash flow. Clients who take a lengthy amount of time (over 30 days) to pay their invoices significantly affect your firm's cash flow.

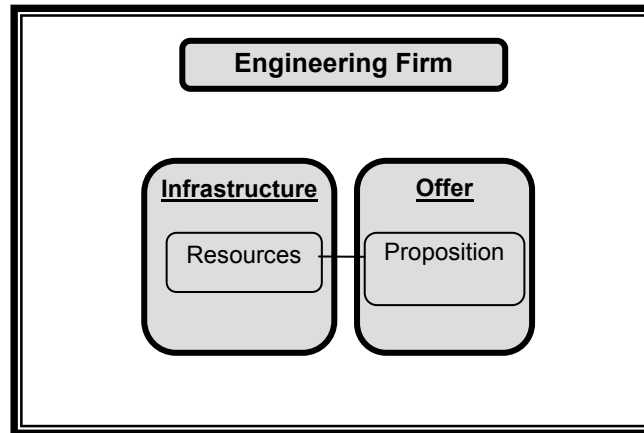
Figure 7 – How the Company Makes Money



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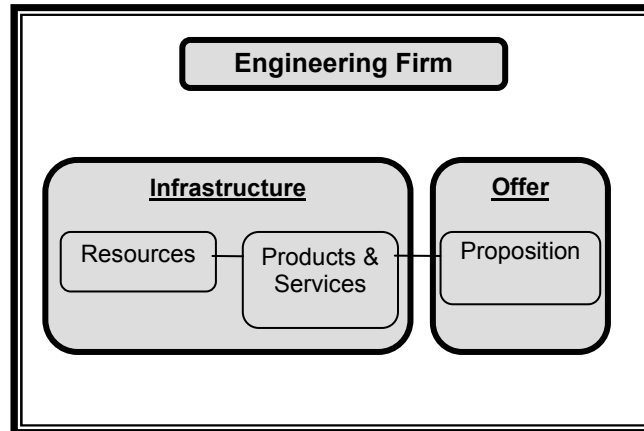
- **Resources** – What staff, equipment and other resources does your firm have to complete the contract? (Figure 8) Certain tasks can not be completed unless the appropriate resources are available. Some resources may even be assigned to other tasks, which mean the operations will be held up until the resources become available.

Figure 8 – Capabilities required by the Company



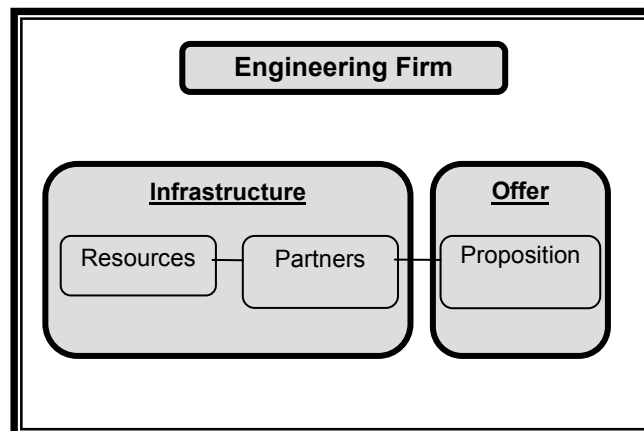
- **Operations** – How will your company operate to produce a quality service and product per the contract to the client? (Figure 9) The firm must be able to match the available resources to produce the necessary products and services that the client wants.

Figure 9 – Activities required by the Company



- **Out-Sourcing** – Where your company lacks the in-house resources to complete the contract, what partners and/or outside resource do you have agreements with to fill those gaps? (Figure 10) This also when is important to having partners to provide certain services when some of your in-house resources have already been assigned to other tasks.

Figure 10 – The Company's Support Partners

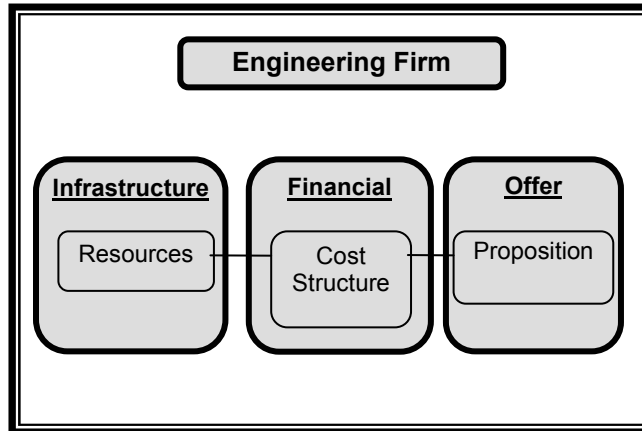


- **Break Even** – In order to pay the staff, utilities, loans, office lease, and other bills what is the minimum amount of cash flow does your company need monthly to

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operate? (Figure 11) In order to provide those products and services that your clients want, your firm must have the cash flow to sustain it and fulfill the contract.

Figure 11 – The Cost to Do Business



As you can see the Business Model is a graphical representation of your business. Answering these questions forms the basis to your Operations Plan. See the sample Operation Plan at the end of this guide.

Sample Operational Plan

(EXAMPLE ONLY)

The following section will identify the proposed operational plan for HAUNTEC Civil Engineering Services (HAUNTEC). Included are the general operating procedures, human resources, insurance, and working capital requirements of the business. Also included is a table outlining the office space requirements, asset acquisition and an outline of Terra Engineering's operational workflow.

General Operating Hours

HAUNTEC Civil Engineering Services operates Monday thru Friday from 9 am to 5 pm. HAUNTEC is operational year round with the exception of Federal holidays and the week between Christmas day and New Years day.

Human Resources

Mr. Haun, Mr. Holton and Mr. Smith are currently the sole employees of HAUNTEC for the first two years of operation.

Mr. Haun is a civil engineer with *Master of Science in Engineering* degree in Civil and Environmental Engineering and holds a Nevada Professional Engineering license.

Mr. Holton is a surveyor with Nevada Professional Land Surveyor license.

Mr. Smith is a CAD operator.

When additional human resources are needed, HAUNTEC has identified the persons qualified and able to assist on a contract basis for an agreed rate.

They include:

Mr. Bret Long, a civil engineer specializing in Land Development, is sub-contracted to complete work as needed. It is estimated that Mr. Long will eventually be hired full time by HAUNTEC once demand warrants growth.

Mr. Chad Short, a civil engineer specializing in traffic engineering, is sub-contracted to complete work as needed. It is estimated that Mr. Short will eventually be hired full time by HAUNTEC once demand warrants growth.

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Mrs. Joann Sharp, a CAD operator, holds an Associate in Science degree in Design and is also be sub-contracted to perform work for the company. Eventually, HAUNTEC intends to hire Mrs. Sharp full time.

Mr. James Dull, a CAD operator, holds an Associate in Science degree in Design and is also be sub-contracted to perform work for the company. Eventually, HAUNTEC intends to hire Mr. Dull full time.

GEO, a geotechnical company, is retained to perform geotechnical surveys and reports.

TRAFFIC COUNTS, a traffic engineering supporting company, is retained to obtained field data such as traffic signal timing and traffic volume.

TECHNCIAL PRINTERS, a printing company, is retained to print large volume projects including development plans and reports.

HAUNTEC does not anticipate sufficient growth to hire more than one employee this year. Once the business has reached 7000 billable hours, HAUNTEC will offer one of the above professionals (engineers and CAD Operators) a full time position. If the sub-consultants refuse the offer, HAUNTEC will seek an individual to fill this position. Filling vacancies will begin by placing ads on Craig List and in local papers and organizations to attract a good pool of applicants.

An administrative assistant is not sought at this time.

New employees, once hired, will be covered by the Workers Safety and Insurance Board and covered for Employment Benefits.

Insurance Requirements

HAUNTEC will continue to incur costs for business liability insurance and professional liability insurance. The estimated costs for these insurances are as follows:

Business Liability	\$750 per year
Professional Liability	\$5,300 per year

Operating Capital Requirements

Due to the economic conditions in the local market, HAUNTEC will continue to have sufficient working capital to meet all operational responsibilities of the business for a minimum of six months.

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It is estimated that the business will need approximately \$150,000 in working capital to sustain and ensure the business meets all on-going financial obligations.

Due to the low number of available development contracts, it continues to be anticipated that throughout this year there will be extended periods of low billable hours. Consequently, the company will experience financial pressures during these months or minimum cash flow. While much of this time will be spent developing proposals and marketing strategies, there will be a need to maintain sufficient working capital to cover these periods.

A long term strategy to maintain a positive cash flow during these periods will be to continue to diversify the company and develop other profit centers. These new profit centers are joint ventures with developers to design and build four projects including a Medical Office building, a Museum, a Themed Shopping Center and an Independent Living facility.

Office Requirements and Asset Acquisitions

HAUNTEC leases office space located at:

800 North Rainbow Boulevard, Suite 208
Las Vegas, Nevada

The office space is leased and accommodates the business office equipment such as computers, fax machine, photo copier, plotters, survey equipment, and other engineering equipment. This facility has a waiting room for clients, conference room, three offices, and CAD bay with four positions.

These facilities are leased at \$2,500 per month including utilities. In addition, HAUNTEC is not requiring any additional specialized equipment this year. If possible, HAUNTEC does anticipate obtaining used survey equipment desk and chairs from distressed companies. These are the estimated costs associated with those investments:

Office Equipment and Furniture \$2,000
Specialized Survey Equipment \$20,000
Total Capital Costs \$22,000

The above noted capital purchases will increase work effectiveness, enhance professionalism and will prepare the business for the forecasted demand for services. Further, the survey equipment may be leased out to other companies when not in use.

Operational Workflow

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As with any consulting firm, the operational workflow for the business is quite uniform and simple to follow. The following is a step by step outline of how contracts are completed on a regular basis:

Step 1 - HAUNTEC will respond to a request for proposal (RFP) from the government (city, county or state) or private entity with a professionally prepared proposal for service;

Step 2 - At this point, the potential contract is awarded to either HAUNTEC or another company which submitted proposals for services. Therefore, communication is made by the contract to the successful consulting firm. If HAUNTEC is successfully selected to perform the work, the contract is then triggered to begin;

Step 3 - HAUNTEC will collect a deposit (retainer) from the client and will begin the project. Retainer values vary depending upon the size and location of the project and the reputation of the client. Generally larger contracts over a \$200,000 require a retainer of 10%, while lesser amount requiring a retainer of 25%;

Step 4 - HAUNTEC will go ahead and start the project while keeping communication with the client. The client will be invoiced monthly for services completed. At each milestone the client will be need to be current in billing before HAUNTEC proceeds with the agreement;

Step 5 - Once the work is completed to the satisfaction of both, HAUNTEC and the client, the final payment for the contract will be made.

The above operational workflow is very standard, easy to understand and within industry's norm.

HAUNTEC will accept cash, check and visa payments. These payments are well within industry standards. The business will provide credit to larger account holders.

It is estimated that the length and terms of payments are net 30 for all clients. This will allow the business to avoid cash flow problems. Late payment charges are 2% of the projects outstanding balance.

A Competitive Operations Strategy

The company's Operation Strategy can be marketed to potential clients as a main benefit in obtaining the firm. In determining the company's Operation Strategy that is competitive in

the market the firm must first determine its core capabilities. The core capabilities are defined as the skill or set of skills that allows the firm to differentiate itself from the competition. The core capabilities in an engineering company's Business Model are the infrastructure's resources.

The success of the Operation Strategy depends on commitment and understanding risk of failure. The key factors of success are breaking down the strategy by work area, involving the team in creating the operation strategy, considering the risk, and getting commitment from the team. Having the plan on paper is meaningless unless everyone is made aware of it, and is onboard in the implementation and accountable to the plan. In addition, the plan should be updated periodically to make sure that the intended results are being accomplished, and if those results are not being accomplished the necessary revisions should be implemented.

8 Keys to Competitive Operations



Key 1: Shorter Product Cycle

Your company can adapt to new types of projects quicker than your competition. As an example the green movement has become an ever increasing integral part of engineering design. The companies that were able to obtain LEED certification first were able to market their new ability to team up with other LEED consultants. Project funding from the government for new projects are requesting this certification on their projects. In short, the first companies with a new product or service gets the greater share of the market.

Key 2: Production Flexibility

The ability of your company to shift from one type of project to another also is major benefit to your clients. In Land Development the ability to shift from residential design to commercial design, and then to public facility design such as parks and recreational facilities is a major benefit to a developer of master planned communities. One company can do the entire design instead of a number of firms specializing in a few of the land use disciplines.

Key 3: Low-Cost Process

The more efficient the process is in developing a product or service the quicker the end product is delivered to the customer. Engineering redesigns cost not only the engineering company, but also the client. Engineering companies generally update their software when necessary; usually when review agencies have commented on the out-dated software or the transfer of data becomes overly cumbersome to exporting to earlier versions of the software.

But up to date software can be a major benefit to your clients; especially if it allows your staff to provide the technical reports and drawings quicker than your competition. The goal is always to get the best design the first time, and minimize revisions and redesign. The time required to draw a set of civil plans for a 100 residential unit project site using AutoCAD 2005 software without the Land Development Design (LDD) package versus AutoCAD Civil 3d 2010 is significant. Developing a track record as the engineering company that has error free plans using the latest technology is a major benefit to customers.

Key 4: Convenience and Location

This may be hard to deliver for a small firm, since having a number of offices maybe difficult if the workload does not support the office expenses. If you have a major project and it is economically feasible, a more appropriate method is to open a branch office near the project site or client's office for the client's convenience. This can be done in the main company's home town or in another city or state. The size of the staff will depend on the workload. Of course the new office will also need to be properly licensed.

Key 5: Product Variety and Facility Size

Niche marketing can be very successful as long as that niche is needed. Once the competition also includes your service or product, you will see a rapid decline in your business. An example is that you are extremely good at writing and preparing Traffic Impact Analysis (a.k.a. Traffic Reports). You found that most engineering companies in your area outsource this service to another company out of town. The local governments are now requiring that nearly ever new development project to include Traffic Reports. To service this new demand, you decide to start a new service at your company by offering Traffic Reports to the local community. Marketing is easy, and the workload quickly overwhelms your small shop. So you hire and train new staff. Eventually the workload levels off, and stays that way for a number of years. Then you notice the workload is slowly dropping off. A quick survey of your previous and current clients shows that your competition has either trained their staff to provide this service or they have also hired staff to specifically provide the same service. They can now offer their clients the benefit of economies of scale. They can now offer more services to their clients and for less. From this point on your client base will continue to decline unless you start adding other services or change your strategy.

Key 6: Quality

Quality is very difficult to demonstrate to potential clients. For a professional service company like engineering this is measured more on the company's reputation. When you think of the best companies in town who are they? When you ask other engineers who are the best engineering companies in town are they similar to your list? Why is that? Due to these companies' reputation, they generally have a much higher demand for their services

and they charge a higher price. You can garner the same attention by increasing your firm's presence in the market with quality design that saves your customers money. This alone will drive more customers your way.

Key 7: Environmentally Friendly Processes and Products

Protecting the environment by selecting processes that are safe to the environment is a major part of the green movement campaign. Being at the forefront of this movement can be a major benefit to your company and clients. Calling out green products in your designs were applicable and economical, looks good to an environmental friendly client. In some instances an additional cost for a green product is not unacceptable to a client, if he can recoup the cost in the long run.

Key 8: The Use of Information

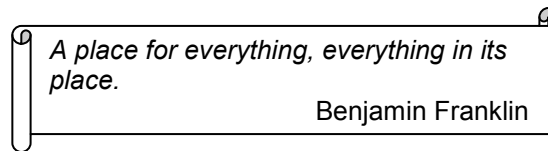
Engineers are very adept at working with Information Technology, but they are also very conservative. Once they find software that solves their needs, they don't want to test newer versions of the software or other software. New technology including the software and hardware is often able to handle and store far more information, and at a cheaper cost. Good examples of this are lap tops and smart phones. Use of technology in the field allows the engineer access to data, drawings and information that the client needs. The engineer can complete a certification letter on the devices, print, stamp and sign, and hand the document over to the client in the field. The engineer does not have to return to the office and mail or hand deliver the certification document to client which saves time and money, but also allows the engineer to perform additional tasks. Making more use of this technology can be a competitive advantage.

Now, it's time to jot down some thoughts.

What Competitive Operations Strategies has your company implemented?

What other Competitive Operations Strategies could your company implement?

Designing the Production System



Although your engineering firm is a professional service company, it probably does produce some products; development plans, technical reports, technical drawings, and so on. The Operations Manager is responsible for selecting the product design, the production/service system, and the inventory policy for finished goods for each product line. For most engineering companies the operations manager is the project manager.

- Product Design
 - Customized Product Design – Products are designed to meet individual customer needs. The emphasis is on quality and on-time delivery.
 - Standardized Product Design – Importance is on cost-control and quality.

Example: Most Improvement Plans are extremely customized. The company's reputation is based on providing quality plans that require few if any revisions and meet or exceed project milestones. Within the company many of the steps in processing the design of the plan set can be standardized. Various details utilized by the staff can also be standardized.

- Production System
 - Product-Focused Systems: Employed in mass production – standardizing products.
 - Process-Focused Systems: Generally for a single task (highly flexible) used in customized products.

Example: In general, the production of design and plan sets is process-focused. A well organized design team understands the process, and works together to constantly improve the process.

- Service System

- Customer-Oriented: Extremely Customized service. Strong customer relationships. Depends on loyalty between the customer and the business. Most small firms use this type of system.
- Process-Oriented: The business concentrates on the process. Streamlining the business system to reduce costs. Medium size firms tend to follow this system.
- Service-Oriented: The business looks to diversify the types of services provided to the customer. New departments and staff are created to support the new services. Larger firms tend to use this system.

Example: The engineering company is extremely customer-oriented. This is due in large part that most engineering firms are quite small. Even large engineering companies are actually a group of smaller sections each with their own set of clients. The section cross sell the services of the other departments to their clients.

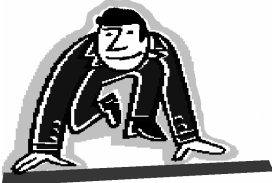
Finished Goods Inventory Policy

- Produced-to-Stock Policy (Make-to-Stock) – Produced in anticipation of demand and stored until receiving customer orders.
- Produced-to-Order Policy (Make-to-Order) – Production starts after receiving the customer order. Made to customer specifications.
- Assemble-to-Order Policy – Products and Services are added options according to customer specifications

Example: Because each new job is different with its own set of constraints, the engineering company has no set of plans setting on the shelves ready for the next client. So providing a set of Improvement Plans for a residential project fits the category of Assemble-to-Order Inventory Policy.

Product/Service Design and Development

Every new Product and Service the company brings on line has a Life Cycle. This cycle is often described as the S-curve.



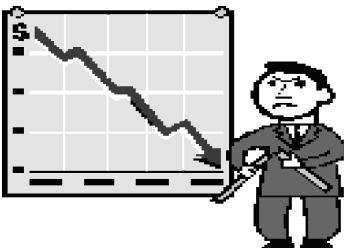
- **Introduction Stage** – During this stage sales are low and slow. The product or service is just being presented to the market, and the potential clients are being educated on how its benefits. The time period within this stage depends on promotion, other marketing efforts, and the market need for the product or service. Profits are negative or insignificant.



- **Growth Stage** – Those products who survive the introduction stage enter the growth stage. In this stage the market is aware of the product or service and knows that they need and want it. Sales increase exponentially. Expansion is discussed.



- **Maturity Stage** – Eventually the sales begin to level off. In order to increase profits focus is placed on improving efficiency of the process, minimizing costs, etc.



- **Decline Stage** – Sales decline due to obsolescence of technology, changing client requirements, the availability of substitute or complementary products, and/or a decline in the market.

Example: An engineering company is known for providing Traffic and Transportation Engineering for Public Works projects, but it wants to expand its services to the private sector. During this introductory stage they know that it will take some time for the potential private sector clients to become accustomed to the fact that the firm has expanded to providing Improvement Plans for residential developers. Initially the

company informs its current clients of their new service, but since most of them are with the government, the need for the new service is very low. The company expands its marketing to local home developers, and again the request for proposals are very low because the business is a relative new comer to the market. After many months of marketing the company has begun to work on one or two contracts. The clients are happy with the service and ask the company to work on their next projects. The company is able to gain existing client loyalty and garner some new clients. They have finally entered the growth phase. Throughout the next several years they continue to gain new clients, until finally they level off with a consistent amount of residential improvement plan work; the maturity phase. After several more years the community has grown to its capacity and the amount of new developments have dropped off. The company is now seeing fewer residential development projects, and they have reached the decline stage. At this point the company has to find other markets in order to maintain revenues.

What stage are your company's services and products?

Service:	<input type="checkbox"/> Introduction <input type="checkbox"/> Growth <input type="checkbox"/> Maturity <input type="checkbox"/> Decline
Service:	<input type="checkbox"/> Introduction <input type="checkbox"/> Growth <input type="checkbox"/> Maturity <input type="checkbox"/> Decline
Service:	<input type="checkbox"/> Introduction <input type="checkbox"/> Growth <input type="checkbox"/> Maturity <input type="checkbox"/> Decline
Service:	<input type="checkbox"/> Introduction <input type="checkbox"/> Growth <input type="checkbox"/> Maturity <input type="checkbox"/> Decline
Product:	<input type="checkbox"/> Introduction <input type="checkbox"/> Growth <input type="checkbox"/> Maturity <input type="checkbox"/> Decline
Product:	<input type="checkbox"/> Introduction <input type="checkbox"/> Growth <input type="checkbox"/> Maturity <input type="checkbox"/> Decline
Product:	<input type="checkbox"/> Introduction <input type="checkbox"/> Growth <input type="checkbox"/> Maturity <input type="checkbox"/> Decline

Now that you have had some time to think about your services and products, you may want to think about adding new services and products to compliment or replace those that are in the mature or declining stages.

Steps to the Development of New Products

Introducing a new product or service to the market can be daunting, but even here there are steps that if taken can ease some of the stress and worries.

- **Idea Generation** – There a number of new products and services that can be added to any engineering company's menu. Based on the company's capabilities some product and services are better suited then others. The idea in this step is to generate as many possible ideas as possible. This is also commonly referred to as brainstorming.
- **Feasibility Studies** – Each new product and services initially cost money to implement and to market. Understanding the cost to benefit of each possible product

and service is best to be understood before the selection process. When looking at the cost include what new equipment, software, technology, and staffing will be required. In addition, estimate the length of time to make a profit and what the sales need to be in order to break even.

- **Prototype Design** – Once the new product and service has been selected the next step is to create a prototype. Whether a service or an actual product like Improvement Plans a sample needs to be created for testing and improvements.
- **Prototype Testing** – The next step is to take the prototype product or service out for a test drive to discover its limitations. Does the product and service do what you expected? Is it better or worse? Can it be improved further? Once these and many other questions have been answered, the prototype will need to be modified and improved until it meets or exceeds the competition.
- **Initial Design of Production Model** – Once the new product or service prototype kinks have been worked out, the next step is the design or layout of the new product or service. Improvement Plans should have a consistent layout and appearance for the company. The company should create checklists to allow the designer, engineer, and the company's reviewer to check and review the plans for any errors, missing designs, or vague details and notes.
- **Economic Evaluation** – Can the product or service be sold in the market for a reasonable profit to the company? Does the cost to produce the product or service within the anticipated or acceptable margins? If higher, can it be modified to fall within the margins? Should the new product or service be sold as a fix fee line item or as time and material? Producing a Technical Drainage Study that cost the company \$5,000 to create and produce, but clients want pay more than \$4,500, will require additional testing to either reduce the production cost or increase the client's perceived value. If you can not make a profit from the new product or service, then it is not prudent for company.
- **Market Testing** – The next step is to perform a small scale market test. This is best facilitated by marketing your existing clients. Once the new product or service has been used by your small test market, your firm should follow-up with a survey to determine your clients' likes and dislikes about the new product or service.
- **Final Design of Production Model** – Finally, with the market testing results make the final revisions to the product or service and full speed on the marketing to the masses.
- **Technology Selection and Process Development** – There is as much competition in the market with various types of technology as there are competitive engineering companies. Select the best technology for your intend use. A \$5,000 piece of

software may be able to provide you what you need and a whole lot more, but maybe a \$500 piece of software may also provide the same information without all of the bells and whistles. Plan out in detail the necessary technology and every step required to produce the product or service.

- **Allocation of Resources to Strategic Alternatives** – Next determine what resources are required to produce the product or service. These resources will be equipment, material, software, and staffing. Determine what resources you already have within the company or outsourced, and what is yet required.
- **Facility Planning** – Bringing on a new product or service may require additional space or even adjusting the furniture around to make room. Adequate facilities to produce the new product or service without compromising your current products and services are critical to the competitiveness of the organization.

Service Strategy – Processes and Technology

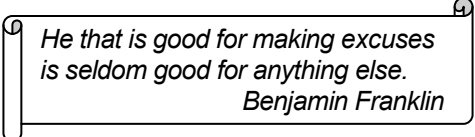
Service firms like engineering companies can be divided into four (4) categories:

- Professional Service: Highly customized and labor intensive
- Service Shop: Customized and labor intensive
- Mass Service: Less customized and less labor intensive
- Service Factory: least customized and least labor intensive

Note: Generally, engineering companies are categorized as Professional Service. This is primarily due to the fact that no two projects are exactly the same even for the same client, and all services and products are labor intensive.

Developing Operations Manuals

Operations Strategy should be inline with the organizational strategy, which should be inline with the corporate vision and mission. Selections of markets are the key to any strategy. After markets are analyzed for their attractiveness, operations managers develop appropriate processes and designs to achieve the organization's objectives.



*He that is good for making excuses
is seldom good for anything else.
Benjamin Franklin*

A written document that often goes unnoticed is the office standards and procedures. No matter what size the company, a clearly written operation manual that is followed by the staff can save the budget thousands of dollars. Have you heard of someone saying that in your engineering profession every job is different and that there is no way to have a set of procedures to follow? That is wrong. Procedures evolve and change in time as needed to modernize, but also to address new circumstance not thought of in the past. The military is notorious for procedures. On the flight line in the Air Force, technicians have to have the procedures book opened to the page describing exactly the steps they should be taking to test, monitor, or replace a part on the aircraft. Any mistakes can cause at a minimal an inoperable airplane and worst the lost of the plane and the aircrew due to a mishap in the air. A Professional Engineer's mistake can cause failures that cost thousands if not millions of dollars to fix or repair, and those major mistakes can have the potential of causing the loss of life.

To avoid mistakes procedures can be sit-up for any operation in the office, and all of the office procedures together produce the office standards manual or Operations Manual. Management must be diligent in requiring the entire staff to follow the manual; not allowing anyone to deviate. Flexibility is built into the Operations Manual (Manual) by providing guidelines were possible and specifics as necessary. The size of storm drains should be determined by company approved methods that meet or exceed the local requirements. Required local entities general notes are very specific in the Manual. Individuals are encouraged to make suggestions in revising the Manual, and then a committee should be formed to review suggestions and recommendations. The committee should then take the necessary steps to accept or decline the recommendations along with a written justification notifying the staff and revise the Manual if necessary. This may sound like a cumbersome procedure, but once implemented does becomes routine.

The following is different types of procedures that should be included in the Operations Manual.

Types of Standard Operating Procedures (SOPs)

SOPs may be written for any repetitive technical activity, as well as for any administrative or functional programmatic procedure. General guidance for preparing both technical and administrative SOPs are as follows:

Guidelines for Technical SOP Text

Technical SOPs can be written for a wide variety of activities. Examples are SOPs instructing the user how to perform a specific analytical method to be followed in the office such as a rip-rap design for armoring the banks of a proposed earthen channel, or the CAD standards for designing the channel, or in the field for staking out the sides of the channel in order to install the rip-rap or collecting of samples for soil laboratory analysis. Technical SOPs are also needed to cover activities such as data processing

and evaluation (including verification and validation). The process of converting survey data from field notes, aerial photos, and legal descriptions to a site boundary and topographic map should be written in detail in the Operations Manual for surveyors, CAD Operators, and engineers to follow.

Example: Attempts in establishing CAD Standards

As a CAD designer in the office, an engineering company's design team has had difficulty in using standard details from the other company design teams, because no one seems to use the same layers, styles, line types, or much else. Usually, the best they can do is to make a copy and then redraw the detail, which costs the company a lot of time.

After suggesting and eventually convincing the Department Manager, they were able to form a CAD standards committee. The committee agreed to create several standards that everyone in the department could use. The standards will initially only cover a few items like a standard plot configuration, basic layers, and a few standard details. Over time the standards will increase to nearly ever CAD standard.

The company's design teams can now spend more time on the design process and not on routine CAD details due to inadequate standards. All of the design teams can now readily accept the standard CAD files, and the standard details are stored in a computer network directory that everyone has access to, and every CAD Operator has a copy of the standards at their desk for easy reference.

The CAD standards team will continue to meet to discuss problem areas, and improve the standards.

Citing published methods in SOPs is not always acceptable, because cited published methods may not contain pertinent information for conducting the procedure in-house.

Technical SOPs need to include the specific steps aimed at initiating, coordinating, and recording and/or reporting the results of the activity, and should be tailored only to that activity. Technical SOPs follow the outline presented below, but this format can be modified, reduced, or expanded as required.

The following text was excerpted from a United States government's publication.

In general, technical SOPs consist of five elements: Title page, Table of Contents, Procedures, Quality Assurance/Quality Control, and References:

1. Title Page
2. Table of Contents

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3. Procedures - The following are topics that may be appropriate for inclusion in technical SOPs. Not all will apply to every procedure or work process being detailed.
 - a. Scope and Applicability (describing the purpose of the process or procedure and any organization or regulatory requirements, as well as any limits to the use of the procedure),
 - b. Summary of Method (briefly summarizing the procedure),
 - c. Definitions (identifying any acronyms, abbreviations, or specialized terms used),
 - d. Health & Safety Warnings (indicating operations that could result in personal injury or loss of life and explaining what will happen if the procedure is not followed or is followed incorrectly; listed here and at the critical steps in the procedure),
 - e. Cautions (indicating activities that could result in equipment damage, degradation of sample, or possible invalidation of results; listed here and at the critical steps in the procedure),
 - f. Interferences (describing any component of the process that may interfere with the accuracy of the final product),
 - g. Personnel Qualifications/Responsibilities (denoting the minimal experience the user should have to complete the task satisfactorily, and citing any applicable requirements, like certification[s],
 - h. Equipment and Supplies (listing and specifying, where necessary, equipment, materials, reagents, chemical standards, and biological specimens),
 - i. Procedure (identifying all pertinent steps, in order, and the materials needed to accomplish the procedure such as:
 - i. Instrument or Method Calibration and Standardization
 - ii. Sample Collection
 - iii. Sample Handling and Preservation
 - iv. Sample Preparation and Analysis (such as extraction, digestion, analysis, identification, and counting procedures)
 - v. Troubleshooting
 - vi. Data Acquisition, Calculations & Data Reduction Requirements (such as listing any mathematical steps to be followed)
 - vii. Computer Hardware & Software (used to store field sampling records, manipulate analytical results, and/or report data), and
 - viii. Data and Records Management (e.g., identifying any calculations to be performed, forms to be used, reports to be written, and data and record storage information).
4. Quality Control (QC) and Quality Assurance (QA) Section - QC activities are designed to allow self-verification of the quality and consistency of the work. Describe the preparation of appropriate QC procedures (self-checks, such as calibrations, recounting, re-identification) and QC material (such as blanks - trip, field, or method; replicates; splits; spikes; and performance evaluation

- samples) that are required to demonstrate successful performance of the method. Specific criteria for each should be included. Describe the frequency of required calibration and QC checks and discuss the rationale for decisions. Describe the limits/criteria for QC data/results and actions required when QC data exceed QC limits or appear in the warning zone. Describe the procedures for reporting QC data and results.
5. Reference Section - Documents or procedures that interface with the SOP should be fully referenced (including version), such as related SOPs, published literature, or methods manuals. Citations cannot substitute for the description of the method being followed in the organization. Attach any that are not readily available.

Guidelines for Administrative or Fundamental Programmatic SOP Text

Again the following text was excerpt from a United States government publication.

As with the technical SOPs, these SOPs can be written for a wide variety of activities, e.g., reviewing documentation such as contracts, QA Project Plans and Quality Management Plans; inspecting (auditing) the work of others; determining organizational training needs; developing information on records maintenance; validating data packages; or describing office correspondence procedures. Administrative SOPs need to include a number of specific steps aimed at initiating the activity, coordinating the activity, and recording and/or reporting the results of the activity, tailored to that activity. For example, audit or assessment SOPs should specify the authority for the assessment, how auditees are to be selected, what will be done with the results, and who is responsible for corrective action. Administrative SOPs should fit within the framework presented here, but this format can be modified, reduced, or expanded.

In general, administrative/programmatic SOPs will consist of five elements: Title page, Table of Contents, Procedures, Quality Assurance/Quality Control, and References.

1. Title Page
2. Table of Contents
3. Procedures - The following are topics that may be appropriate for inclusion in administrative SOPs:
 - a. Purpose – (identifying the intended use of the process)
 - b. Applicability/Scope (identifying when the procedure is to be followed),
 - c. Summary of Procedure,
 - d. Definitions (defining any words, phrases, or acronyms having special meaning or application),

- e. Personnel Qualifications/Responsibilities (identifying any special qualifications users should have such as certification or training experience and/or any individual or positions having responsibility for the activity being described),
 - f. Procedure, and
 - g. Records Management (specifically, e.g., as forms to be used and locations of files).
4. Quality Control and Quality Assurance Section - Describe any control steps and provisions for review or oversight prior to acceptance of the product or deliverable. This can include test plans such as verification and validation plans for software or running a “spell-check” program on the finished document.
 5. Reference Section - Cite all references noted in the body of the SOP. A copy of any cited references not readily available should be attached to the SOP.

Developing Quality Control and Quality Assurance Programs

Having to repeat or redo work is the easiest way for an engineering firm to lose money. Therefore, it is best to limit the amount of rework if possible, and the best way to avoid these costly design mistakes is to set up a Quality Control and Quality Assurance (QC/QA) program. No matter what size your engineering business or the number of employees it employs, it is best to have a QC/QA program. The QC/QA system eliminates routine mistakes, which by itself will set your engineering company above the competition. It is easier to set up a QC/QA program while the business is small, than when the company has grown to a much larger firm. As the firm grows the QC/QA program can be modified and updated as needed.

The QC/QA program can be as simple as having a second person review all plans against a checklist to make sure that minor mistakes are avoided. The second person does not have to be the same person all of the time. These checklists can be derived from common mistakes found from past agency and in-house reviews.

There is a difference between Quality Control and Quality Assurance. Quality Control is a process implemented by the firm to ensure a certain level of quality is achieved in a product or service. In an engineering design firm, it may include whatever actions the business deems necessary to provide for the control and verification of certain characteristics of a product or service. The basic goal of Quality Control is to ensure that the products and services provided to the public consistently meet specific company standards.

Once the Quality Control process identifies a product or service that does not meet a company's specified standards of quality, the next step is to correct the problem and to

ensure that future products or services will also meet the standard by adding the corrective measures to the Operations Manual.

Quality Control can cover not just products and services, but also people. Employees are an important part of an engineering company. In fact, the staff is the company. If a company has employees that do not have adequate skills or training, have trouble understanding directions, or are misinformed, quality may be severely diminished.

Often, Quality Control is confused with Quality Assurance. Though the two are very similar, there are some basic differences. Quality Control is concerned with the product or service, while Quality Assurance is process-oriented.

Quality Assurance is designed to make sure processes are sufficient to meet objectives. Simply put, Quality Assurance ensures a product or service is manufactured, implemented, created, or produced in the right way. Quality Assurance is the process of verifying or determining whether products or services meet or exceed customer expectations, and it is a process-driven approach with specific steps to help define and attain goals. This process considers design, development, production, and service.

Dr. W. Edwards Deming, the developer of Total Quality Management, summarized Quality Assurance as a cycle consisting of four steps: Plan, Do, Check, and Act. These steps are commonly abbreviated as PDCA.

The four quality assurance steps within the PDCA model stand for:

- **Plan:** Establish objectives and processes required to deliver the desired results.
- **Do:** Implement the process developed.
- **Check:** Monitor and evaluate the implemented process by testing the results against the predetermined objectives
- **Act:** Apply actions necessary for improvement if the results require changes.

PDCA is an effective method for monitoring Quality Assurance, because it analyzes existing conditions and methods used to provide the product or service to customers. The goal is to ensure that excellence is inherent in every component of the process. Quality Assurance also helps determine whether the steps used to provide the product or service is appropriate for the time and conditions. In addition, if the PDCA cycle is repeated throughout the lifetime of the product or service, it helps improve internal company efficiency. The goal to exceed customer expectations in a measurable and accountable process is provided by Quality Assurance.

Developing Checklists

The Quality Control (QC) and Quality Assurance (QA) process may sound like a very complicated process, which requires a great deal of money to implement and to

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maintain. But, in fact, it can be a very simple process of basically following checklists. As each new job is completed the checklist is revised or altered as needed for situations that were not previously covered. As an example, a civil engineering company may create a checklist for checking a grading plan sheet. The initial checklist is based on the engineer's and CAD Operator's previous experience, the plan is submitted into the local government for review, and about three weeks later the company receives a list of comments from the city that needs to be addressed. After addressing the comments and revising the Grading Plan the plan is return to the city for additional review. Meanwhile the checklist is revised with the agency's comments. This process removes the typical agency comments in the future. The process is repeated when the plans are submitted to other agencies for review, and it is repeated for all future projects submitted for review. Eventually the checklist covers nearly ever-conceivable situation, and the plans are submitted to any agency with minimum comments. The checklist becomes extremely valuable to the company, because it saves time by not having to revising the drawings several times due to the typical mistakes or oversights that the competition continues to repeat.

Sample Operational Plan

(EXAMPLE ONLY)

The following section will identify the proposed operational plan for HAUNTEC Civil Engineering Services (HAUNTEC). Included are the general operating procedures, human resources, insurance, and working capital requirements of the business. Also included is a table outlining the office space requirements, asset acquisition and an outline of Terra Engineering's operational workflow.

General Operating Hours

HAUNTEC Civil Engineering Services operates Monday thru Friday from 9 am to 5 pm. HAUNTEC is operational year round with the exception of Federal holidays and the week between Christmas day and New Years day.

Human Resources

Mr. Haun, Mr. Holton and Mr. Smith are currently the sole employees of HAUNTEC for the first two years of operation.

Mr. Haun is a civil engineer with *Master of Science in Engineering* degree in Civil and Environmental Engineering and holds a Nevada Professional Engineering license.

Mr. Holton is a surveyor with Nevada Professional Land Surveyor license.

Mr. Smith is a CAD operator.

When additional human resources are needed, HAUNTEC has identified the persons qualified and able to assist on a contract basis for an agreed rate.

They include:

Mr. Bret Long, a civil engineer specializing in Land Development, is sub-contracted to complete work as needed. It is estimated that Mr. Long will eventually be hired full time by HAUNTEC once demand warrants growth.

Mr. Chad Short, a civil engineer specializing in traffic engineering, is sub-contracted to complete work as needed. It is estimated that Mr. Short will eventually be hired full time by HAUNTEC once demand warrants growth.

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Mrs. Joann Sharp, a CAD operator, holds an Associate in Science degree in Design and is also be sub-contracted to perform work for the company. Eventually, HAUNTEC intends to hire Mrs. Sharp full time.

Mr. James Dull, a CAD operator, holds an Associate in Science degree in Design and is also be sub-contracted to perform work for the company. Eventually, HAUNTEC intends to hire Mr. Dull full time.

GEO, a geotechnical company, is retained to perform geotechnical surveys and reports.

TRAFFIC COUNTS, a traffic engineering supporting company, is retained to obtained field data such as traffic signal timing and traffic volume.

TECHNCIAL PRINTERS, a printing company, is retained to print large volume projects including development plans and reports.

HAUNTEC does not anticipate sufficient growth to hire more than one employee this year. Once the business has reached 7000 billable hours, HAUNTEC will offer one of the above professionals (engineers and CAD Operators) a full time position. If the sub-consultants refuse the offer, HAUNTEC will seek an individual to fill this position. Filling vacancies will begin by placing ads on Craig List and in local papers and organizations to attract a good pool of applicants.

An administrative assistant is not sought at this time.

New employees, once hired, will be covered by the Workers Safety and Insurance Board and covered for Employment Benefits.

Insurance Requirements

HAUNTEC will continue to incur costs for business liability insurance and professional liability insurance. The estimated costs for these insurances are as follows:

Business Liability	\$750 per year
Professional Liability	\$5,300 per year

Operating Capital Requirements

Due to the economic conditions in the local market, HAUNTEC will continue to have sufficient working capital to meet all operational responsibilities of the business for a minimum of six months.

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It is estimated that the business will need approximately \$150,000 in working capital to sustain and ensure the business meets all on-going financial obligations.

Due to the low number of available development contracts, it continues to be anticipated that throughout this year there will be extended periods of low billable hours. Consequently, the company will experience financial pressures during these months or minimum cash flow. While much of this time will be spent developing proposals and marketing strategies, there will be a need to maintain sufficient working capital to cover these periods.

A long term strategy to maintain a positive cash flow during these periods will be to continue to diversify the company and develop other profit centers. These new profit centers are joint ventures with developers to design and build four projects including a Medical Office building, a Museum, a Themed Shopping Center and an Independent Living facility.

Office Requirements and Asset Acquisitions

HAUNTEC leases office space located at:

800 North Rainbow Boulevard, Suite 208
Las Vegas, Nevada

The office space is leased and accommodates the business office equipment such as computers, fax machine, photo copier, plotters, survey equipment, and other engineering equipment. This facility has a waiting room for clients, conference room, three offices, and CAD bay with four positions.

These facilities are leased at \$2,500 per month including utilities. In addition, HAUNTEC is not requiring any additional specialized equipment this year. If possible, HAUNTEC does anticipate obtaining used survey equipment desk and chairs from distressed companies. These are the estimated costs associated with those investments:

Office Equipment and Furniture \$2,000
Specialized Survey Equipment \$20,000
Total Capital Costs \$22,000

The above noted capital purchases will increase work effectiveness, enhance professionalism and will prepare the business for the forecasted demand for services. Further, the survey equipment may be leased out to other companies when not in use.

Operational Workflow

ENGINEERING OPERATION STRATEGIES

As with any consulting firm, the operational workflow for the business is quite uniform and simple to follow. The following is a step by step outline of how contracts are completed on a regular basis:

Step 1 HAUNTEC will respond to a request for proposal (RFP) from the government (city, county or state) or private entity with a professionally prepared proposal for service;

Step 2 At this point, the potential contract is awarded to either HAUNTEC or another company which submitted proposals for services. Therefore, communication is made by the contract to the successful consulting firm. If HAUNTEC is successfully selected to perform the work, the contract is then triggered to begin;

Step 3 HAUNTEC will collect a deposit (retainer) from the client and will begin the project. Retainer values vary depending upon the size and location of the project and the reputation of the client. Generally larger contracts over a \$200,000 require a retainer of 10%, while lesser amount requiring a retainer of 25%;

Step 4 HAUNTEC will go ahead and start the project while keeping communication with the client. The client will be invoiced monthly for services completed. At each milestone the client will be need to be current in billing before HAUNTEC proceeds with the agreement;

Step 5 Once the work is completed to the satisfaction of both, HAUNTEC and the client, the final payment for the contract will be made.

The above operational workflow is very standard, easy to understand and within industry's norm.

HAUNTEC will accept cash, check and visa payments. These payments are well within industry standards. The business will provide credit to larger account holders.

It is estimated that the length and terms of payments are net 30 for all clients. This will allow the business to avoid cash flow problems. Late payment charges are 2% of the projects outstanding balance.

Sample Operational Checklist

Table 1 - Typical Tentative Map Checklist

Tentative Map Checklist		
Date: _____ Project Number: _____ Reviewer: _____		
Subdivision Name: _____		
Yes	N/A	Description
		Does the Legend shown on the map show all of the lines, symbols, and markings in the plan?
		Is the Date Prepared updated on the map?
		Is the Map Scale correct?
		Is the North Arrow point up or to the left and aligned with the drawing?
		Are the Names, Addresses, and Telephone Numbers of the Owners of Record, Sub-divider, and Person or Persons who Prepared the map correct?
		Is there a sufficient legal description of the land to describe the location, including a graphic exterior subdivision boundary, dimensions, and approximate acreage? (If streets are not dedicated, the map must be drawn to the centerline of the street)
		Is the location, names, present widths and improvements of adjacent streets shown on the map?
		Do the contour lines of the entire subdivision, have the following intervals: <ul style="list-style-type: none"> i. Two (2) foot contour intervals for ground slopes between level and forty percent (40%). ii. Five (5) foot contour intervals for ground slopes between forty percent (40%) and eighty percent (80%). iii. Ten (10) foot contour intervals for ground slopes exceeding eighty percent (80%). iv. If the slope exceeds twelve percent (12%), it must comply with hillside development regulations and show the limits of such slope.
		Are the width and location of all easements for drainage, sewage, public utilities, and other purposes shown on the map?
		Are the radii of curves shown on the map?
		Are the lot layouts, lot number, and approximate dimensions of each lot shown on the map?
		Is there a key map on the drawing indicating plans for development of the entire area, if the proposed plat is a portion of a larger holding intended for subsequent development?
		Are the location and outline, to scale, of each building or other structure, within the proposed subdivision, noting whether or not each building or structure is to be removed or remain in the development of the subdivision, and other physical features which would influence the layout or design?
		Is the location of areas subject to inundation of storm water overflow, and the location, widths, and direction of flow of all watercourses and proposed storm water drainage and facilities, and also depicting limits of the 100 year flood plain shown on the map?

About the Author

Joe Alvin Haun, PE, MSE

Joe Haun is a highly experienced Civil Engineer, author, public speaker, and business advisor who have worked in the engineering profession since 1983.

Mr. Haun's early career was in the United States Air Force as an Engineer Assistant. A Desert Storm veteran he has a unique perspective of the Middle East.

Mr. Haun graduated from the University of Las Vegas, Nevada in 1994 with a BS degree in Civil Engineering and in 1995 with a MSE in Civil and Environmental Engineering.

Mr. Haun worked with several engineering firms in the Las Vegas valley until February 2005 when open his own engineering company HAUNTEC, which has grown to a designing multi-million dollar projects in Nevada and Utah and in the countries of Iraq and Costa Rica. Review his growing company's website at www.haunteceng.com to see the firm's latest capabilities.

Mr. Haun has published articles in engineering magazines and has given speeches on water resources, and is currently working on several articles on permeable pavements.

In 2009, Mr. Haun started Engineering Business Seminars and Publications to. His first publication is the "Engineering Business Success." He has created many self-study engineering business seminars for Professional Development Hours credits. Visit the web-site www.engineeringbusinesspubs.com to review the latest seminars and publications.

Recommended Reading List

Engineers are constantly learning about new techniques, products and design methods. Improving your skills as a business leader is no different. Reading books is one of the best ways to improve your skills. Below is a list of books we recommend.

- *Engineering Business Success* by Joe A Haun (book)
 - *Engineering Business Plan* by Joe A Haun (seminar)
 - *Engineering Marketing Strategies* by Joe A Haun (seminar)
 - *Engineering Operations Strategies* by Joe A Haun (seminar)
 - *Engineering Financial Strategies* by Joe A Haun (seminar)
 - *Engineering Proposal Strategies* by Joe A Haun (seminar)
 - *Engineering Joint Venture Strategies* by Joe A Haun (seminar)
 - *7 Habits of Highly Effective People* by Steven Covey
 - *First Things First* by Steven Covey
 - *Awaken the Giant Within* by Anthony Robbins
 - *Unlimited Power* by Anthony Robbins
 - *The E-Myth Revisited* by Michael E. Gerber
 - *Get Clients Now* by C. J. Hayden
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- ❖ Please visit our web-site www.engineeringbusinesspubs.com to order Joe Haun products from our recommended book list.
 - ❖ Our on-line seminars include the manual, down-loadable from the web-site www.engineeringbusinesspubs.com , and sample letters and forms. After completing the seminars the participant will receive a PDH certificate showing the number of units awarded.

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