

Advanced Project Management Techniques I & II



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Introduction

This course in project management is intended to improve the prospects for existing project managers and would-be project managers to manage a successful project. The simple definition of “successful” has rarely been defined in specific terms of a given project, but a general definition usually encompasses “being on time and being under budget”. Nevertheless, while this definition may be too narrow to satisfy many PM’s and executives, the project is not “successful” unless you combine these two finite factors with a more than satisfactory end result.

The course is divided into two separate parts, each of which is intended to improve the capabilities of a Project Manager or a potential Project Manager. The first part describes the steps necessary to become a top quality PM, and focuses on the background and education necessary to be considered for a project management role. Once an individual has been considered for this very important position, a PM should take advantage of training and experience opportunities that become available and should also maintain a conscientious effort toward self-improvement. Other items in this first part concentrate on developing characteristics of leadership as well as motivational skills that will improve the PM’s efforts to ensure that your project team will work closely with you so that the project’s goals will be met.

The second part of this course deals with the actual fundamentals of managing a project so that a Project Manager and every team member are performing at an optimum level. This section of the course covers the multiple functions of the project, including the activities necessary to assure that engineering, equipment and construction meet the quality objectives of the project. This portion of the course describes techniques to obtain optimum scope and design parameters as well as how to maintain schedule and cost controls. Examples are given of solutions to problems that are encountered as the project unfolds. The PM is made aware of the subtleties that are available to resolve seemingly difficult issues.

In almost all projects the Project Manager and project team members will develop and utilize some core principles. One of those core principles is that the burden of assuring the finite factors in addition to the end result is primarily the responsibility of the PM. The Project Manager not only needs to know what to do, but also “how to do it” and what to do when a difficult situation presents itself. Invariably, the solution is not begun until the PM and/or the project team members recognize that a problem exists. It can then be resolved with training and experience, each of which is an equally valuable commodity. As you will discover by reading

and studying this course, having personal discipline is very important to a Project Manager. Another sometimes difficult lesson for most PM's to learn is that you can't possibly be everywhere and do everything yourself, so learn to delegate authority by investing your trust in others and discover in this course what you need to know to have a successful project.

Course Outline

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A. Qualifications for a Project Manager

1. Background/Education

Having a college degree is certainly beneficial, but by no means mandatory, to your success as a Project Manager. Depending on the type of project in which you become involved and the overall responsibility that you are given, a specific college degree may or may not be a requirement. Not having a degree in this era, however, may hinder your prospects for future advancement, whether the degree is in engineering, engineering technology, science, or even a non-science degree such as business. This is particularly true if you are considering the role of project manager as a stepping stone within your company or primarily as a potential highlight on your resume.

If you had attended an engineering school, for instance, you may have been led to believe that there are four major engineering curriculums: Civil, Chemical, Mechanical, and Electrical. Possibly you have come to the conclusion that a Project Manager must have one of those major educational backgrounds in order to be considered for a project management position and to function successfully. As you gain in wisdom and maturity and your experience broadens, you may come to realize that there are many subordinate academic studies within the primary areas of study: Piping has become a very specialized and distinctive academic entity. Included in this very important area of formal study are pneumatics (compressed air, instrument air, etc.), hydraulics (lubricants and synthetic fluids, pumps, cylinders, drives and the like), and many variations of these two categories. Civil engineering can run the whole gamut from ground water intervention to architectural support for 100-story office buildings.

Petroleum engineering and chemical engineering are cousins. Chemical engineering and chemical engineering technology have now been sub-divided into numerous categories, many of which now fit into such social engineering parameters as petrochemicals, pharmaceuticals, and even cosmetics. Consider an electrical engineering graduate; electrical engineering can be sub-divided into several categories, including power generation, visible and solid-state motor controls, telecommunications, and electronics where transistors control everything from televisions and satellites to automobiles and airplanes. Items that are “state-of-the-art” one year are practically obsolete one year later. Today’s technology lists hand-

helds of every variety, automobiles that potentially drive themselves, and a treasure-trove of automatic devices that weren't even on the radar thirty years ago. If you are under thirty years of age, you are probably not aware of such names and terminology, for instance, as PC Junior, Commodore, and keypunch operators.

In addition to a background in engineering or computers or some other technical field, many PM's today acknowledge that a background in business and/or finance is equally as important as engineering and technology in becoming a valuable project management tool. Whether or not you have a degree in industrial management or business administration, your value to the project will become abundantly clear as you process the many cost factors involved throughout the project. Your ability to weigh the costs and expenses versus the timelines and calendar challenges of the project is a significant aspect of nearly all projects throughout their duration. While you may have to rely on so-called financial experts to provide you with many of the necessary details, this financial understanding will give you the wherewithal to make decisions in a timely manner. In addition, financial knowledge will also give you an edge in negotiations with team members, suppliers, contractors and many others who may be involved in the project.

2. Experience/Training

In my case, for example, I was transferred from the steelmaking plant where I had begun my career into the large corporate engineering group, and was placed in the Project Management section. Looking around that first morning at the others in that section, I was struck by their ages and seeming experience. Of the fifty or so men – no females among them – spread out over parts of two floors, less than a handful were under the age of fifty-five. Most had been at least division managers – I had been an Area Manager – and several had even been Plant Managers. I learned over the next few months that, not only had they been inexperienced when they had been transferred into this division as Project Managers, but also most of them were lacking in the fundamental skills and techniques of Project Management.

However, on the first day of my new career as a PM, at about 10:00 a.m., I was assigned to two projects that management believed would fit my background and qualifications. One was at a company plant in Salt Lake City, Utah, and the other was at a plant in Houston, Texas. Management suggested that I prepare to meet the project team in Salt Lake City on Tuesday morning, and that they would like me to meet with the project team in Houston on Thursday. I immediately learned three valuable lessons that all PM's should prove to find beneficial:

- a. Always have a suitcase ready.
- b. Have the ability to make your own travel accommodations, even if you have your own administrative assistant or the company has a travel department.
- c. Get a passport and always keep it in your possession. Even travel to Canada usually requires a passport.

My company gave me the opportunity in the second month at my new position to attend a two-week project management training program at a nearby university. The diversity of the people attending this program as well as the many types of company, institutional and organization projects that they were representing was a true revelation. There were men and women representing many different industries and organizations. Furthermore, some valuable project management concepts were presented and developed, and every attendee was asked to participate in the program discussions. While there didn't seem to be a major effort to explain how we should manage a project, there was a concerted effort to prepare us to manage ourselves as Project Managers. Two of the most valuable concepts that were presented and that stayed with me throughout my PM career were:

- a. Keep accurate daily records
- b. Maximize use of your time by establishing your daily project priorities

One of the exercises that comes to mind involved being in a plane crash that occurred in a desert area. All of the passengers were survivors, and we knew that there would be an attempt to rescue us, despite the fact that we would be in a large desolate area where the temperature might exceed 100 degrees F. Each of us was given a list of twelve items from which we could make up a survival kit, and we had to rate each item on the list from highest to lowest in importance and priority. Not one person in the program selected the most important item on the list as Number 1, which turned out to be a small magnifying glass. The second most important item on the list was a basic wrist watch and nobody got that one either. There were no cell phones or any other communication systems available. We also had to plan our daily activities in order to be found and rescued as soon as possible. Many in the program moved in different directions, while others stayed at the crash site, which was the correct thing to do.

Keep Daily Records

The function of keeping accurate daily records is basic to any PM. There are numerous ways in which you can accomplish this. For the more detailed PM, you might consider the use of a Franklin-Covey Daytimer to record meetings and attendees, phone numbers and conversations, and other items of particular interest to you that will serve as your reminder as to what was said and done on a specific date. These notes will save you much time as references and will jog your memory as you recall those activities. Also rest assured that those notes are valid in a Court of Law, should the need ever arise. With modern technology

and the advent of tablets, smart phones, and software for every occasion, such things as speaking your notes and making an album of progress photos is easier than ever. Many project teams today utilize software programs such as Asana and Tracker that not only list the tasks for each project group, but also recognize which tasks have been determined to have greater priorities. Incidentally, utilizing a tape recorder or turning your cell phone into a listening device in project meetings is not usually a good practice for many reasons, including the obvious fact that recording devices may inhibit conversations and limit ideas to potential problem solving. Nevertheless, keeping concise notes of meetings, whether by the PM or a project team associate is essential.

Establish Priorities

There is really an art to establishing project priorities in order to maximize use of your time with your daily activities. Let's suppose that hypothetically your project involves a backup diesel generator, and that you have five phone calls to make after your morning progress meeting with your project team or project group. One of these calls is to the State Environmental Organization that is concerned about some of your design calculations, one of these calls is to an equipment supplier, one is to your Lead Mechanical Engineer, another is to one of your construction contractors who is looking for a delivery date for the equipment, and a fifth call is to a local utility. Logic and experience will tell you that the order of the phone calls has to be: (1) Lead Mechanical Engineer (2) Environmental agency (3) equipment supplier (4) contractor, and (5) the local utility. While this sequence of calls may become fairly obvious, things don't always go as planned. Some of the responses may not be immediate, while others may have a negative connotation that will require follow up phone calls, or even visitations or meetings. Nevertheless, planning your daily activities is nearly as important as planning the project.

In this hypothetical case the Environmental Department is concerned with the amount of carbon emissions that are escaping from the diesel generator that is being specified and purchased for the project. Your first call will be to the Mechanical Engineer who was responsible for the generator specification, and the engineer assures you that the proper filtration system has been specified to meet environmental standards. Your next call is to the Environmental Agency with your assurance that the emissions control system will meet their standards. The third call is to the generator manufacturer to ensure that the emissions system is an integral part of their generator equipment, and that all equipment will be delivered as per the schedule and purchase order. You can then call the contractor – or better yet, have your Construction Manager make the call – to assure the contractor that the equipment will be delivered as required and there will be no extra work involved. Finally, the local utility can be notified that the diesel generator will become part of the project, and that no additional utility requirements will be needed by them.

Seek Formal Training

Hopefully, part of your early training would have been participating in Project Management seminars and conferences, or even being sent to a college or university with a summer curriculum for Project Management training. The school may have a two-week program, but pressing commitments in your company might limit you to be there for only the first week, so cram as much as you can into that first week. Whether you are attending a school or a seminar, you will quickly learn how much you have to learn about Project Management as well as how much effort is required to become a top PM. These courses usually focus on what basic tools can be utilized by you as a practitioner rather than you as an individual Project Manager. They are varied because, as you will quickly learn, there are PM's in nearly every business or industry – manufacturing, road building, banking, healthcare, and even horse racing.

And yet there's no substitute for hands-on experience. Some of the best experience a Project Manager can receive will be the ability to visit a facility similar to the one for which you are responsible, either in your own company or in that of a competitor's company. While visiting that of a competitor may be a little more intricate and involve a certain amount of diplomacy, the rewards can be great in the long run. You will see firsthand the arrangement of the overall facility, the interaction of the adjoining facilities that are required, potential space limitations, and other features that possibly neither you nor your Client(s) had considered. In addition you may be able to discuss with those personnel that are in charge of the operation some of the problems and other subtleties associated with their facility. Also be willing to have others on your project team accompany you on this visit so that you gain their perspective. Sometimes you may determine that visiting more than one similar facility is necessary to gather sufficient information and understanding. Often the supplier of equipment similar to that which you plan to purchase will make the necessary contacts to arrange for a visit of this type to occur.

As your experience level increases, your ability to prioritize the various project functions as well as your own daily objectives will improve. In order to fully understand project priorities, you will have to know the ultimate financial goal of your project, especially as it applies to a late finish. You should be in a position to evaluate how a one month, or a one week, or even a one day delay will affect your company's bottom line. Knowledge of this aspect of the project will allow you to determine the effects of slight, or even major, schedule changes in design, procurement, or construction. In addition you will have the ability, if the need arises, to either tap into the contingency fund, or even go beyond that and justify a request to executive management for additional project funding.

Maintain a Professional Attitude

Although the life of a Project Manager can become very strenuous at times, you are expected by those around you – peers, supervisors, contractors, etc. – to maintain a certain mental posture at all times because you are a **Professional**. Kudos, when they come are great, but don't count on being verbally rewarded; remind yourself that you are expected to

perform at a high level and to produce results. After all, you may have been selected for this position as a promotion, since your reputation was that you are a quick thinker and a strong decision maker who was probably one of the better engineers or financial personnel in your current field. In most cases the first two characteristics were probably true, although your credentials in your specific field may have been only slightly above average. Nevertheless, your background and education have enabled you to comprehend complex situations and make determinations that allowed projects to move forward with a minimum of schedule interruptions.

While you and everyone around you will consider you a consummate professional, you must always draw the line between your own self-confidence and your unwillingness to compromise. Often you and your Client or Boss, or even one of your peers, will have a difference of opinion. Keep in mind that you are usually dealing with a matrix organization wherein nobody is under your direct authority. You must be willing to listen to any team member's opinion or argument and be prepared to give them your point of view on the subject. If your viewpoint is convincing, it will be accepted. If not, keep discreet notes of what has transpired and back off. Remember that no one is born with humility and that it must be developed. Even though you may not be lacking in self confidence, there is almost always at least one occasion during each project when you will be required to humble yourself. Embrace the challenge.

Not only is willingness to give concessions or to compromise a good character trait, but you are also preparing for future situations that might occur. Just as life is temporal, so is your current project. Suppose you encounter a situation such as the following:

Two adjacent transfer systems were side-by-side. One system would be receiving very heavy plate products from another area of the plant by special trucks, while the second system was transferring individual plates into a mill for further production. Once the second system had been emptied, the process would be reversed. The functionality for performing this operation, while still maintaining continuity as well as traffic flow and personnel safety, seemed to be an enigma and had been discussed at all levels of the company for about a month. After hours of contemplation, suddenly you had a vision as to how the problem could be solved, and you told the Client representative about your solution just before a very large and important meeting. During the meeting the Client representative explained "his" method for solving the dilemma. You might have seemed astonished that you were left out of the equation, but you said nothing and routinely carried out your PM duties.

Certainly this type of situation has occurred to a PM at least once in his or her career. As for the project, it was a great financial success. The Client representative, basking in the aftermath of his success, had enough influence to strongly suggest that the PM be given the assignment as PM for the next project, which just happened to be the largest project in the

company, even though he was an outside consultant. Knowing when to be humble and display your loyalty often results in greater future opportunities.

3. Leadership Qualities

What does being a Project Manager mean? Very simply, being a Project Manager means being a project **LEADER**. You have earned the position of Project Manager, and you have been given an assignment Now you must take that assignment and make it your mission. A Project Manager who operates with a clearly defined mission will have an obvious advantage over another PM who cannot embrace a leadership role and doesn't envision a clearly defined mission. This in no way implies that you are to become a project dictator. Remember, as often as is necessary under the circumstances, that the Master of the project is the Client (Owner/Vice President/Technical Director/etc). In spite of your near autonomy in most cases, you still answer to him/her, and must understand the boundaries and limitations under which you can function.

However, as the Leader of the project, you have certain responsibilities as well as specific duties. Some leadership qualities which you are expected to exhibit include:

- a. Enthusiasm
- b. Sincerity
- c. Initiative
- d. Flexibility
- e. Empathy by showing concern for others
- f. Interest in other's opinions
- g. A teachable spirit
- h. Willingness to sacrifice your ego

As was stated earlier one character trait that a true Leader must develop, because nobody is born with it, is humility. A second character trait of equal importance that must be developed by a quality Project Manager is discipline. In the course of a project a Project Manager will call for many meetings and will attend most of those meetings. A good example of discipline is being on time for every meeting in which you are participating. This attitude will resonate throughout your project organization and will establish a path for others on the project team to follow. As has been said many times and in many ways, "your attitude determines you altitude." An even better approach is to be early for these meetings, especially those

that you have called. Being even a little early to a meeting communicates to others that their attendance at the meeting is important, that you value their time, and that your humility does not require you to make a grand entrance.

The manner in which you acknowledge others' ideas, whether you always accept them or not, is also very important. The way that you interact with your peers as well as your clients and supervisors goes a long way toward determining your attitude. You may be looking at the "big picture", but your teammates will determine the success or failure of the project by how well they perform their individual tasks. Thus, paying attention to the smallest detail is as important to you and the project as it is to them. As far as your project team is concerned, there is no insignificant task, and this is both a concept and a general philosophy that you must adopt.

Anyone who is in your position as the leader of the team must remain strong and exhibit an air of confidence at all times. A negative, or defeatist, attitude is not only a danger to your position as a Project Manager, but also becomes a burden to your everyday well being. Those defeatist attitudes that you must try to avoid as a Leader include harboring resentment, giving in to discouragement, engaging in self pity, or even engaging in self rejection. Remember that you are the "go to" guy or girl for many people on your team, and your attitude will reflect their feelings toward the success of the project. This by no means implies that you are to micro-manage your project, but you as the Project Manager must keep a steady hand on the wheel, and be prepared to take action should the project lose its steam or begin to change course.

There are two different categories under which a Project Manager can represent the company for whom the project is being performed: as a Direct Company Representative or as an Indirect Representative.

a. Direct Company Representative

In this category you are an actual employee of the company that is implementing the project. There are several ways that you can benefit from this arrangement. One way is that you might be blessed with a Project Team over which you have substantial control. In this case you would have all the necessary project groups under your direct authority, including Engineering and Design, Cost Control, Procurement and Construction Management answering directly to you. This scenario is quite likely if the project is of such a magnitude and has such financial incentives as to make the Project Team concept viable to Executive Management.

The real dilemma with this concept is twofold: most companies have streamlined their workforce and rarely employ a staff of this nature because of the standby costs involved; and, secondly, this caliber of personnel is more commonly found in the engineering companies and consulting firms that typically perform this work for a variety of companies. Nevertheless, should the financial benefits to the company for whom you are working be warranted, this concept is a strong possibility.

A more likely scenario in this category is what is termed a *Matrix arrangement*. Under these guidelines, certain individuals in each necessary project group who are employed by your company may be assigned to your project, although their direct supervision would come from an Area Manager of that particular company group rather than yourself. In addition those assigned to work with you to implement your project might well be working on two or three other projects or assignments. In this scenario the company will not feel the need to employ additional personnel, and you as the PM will be faced with the situation whereby you will need most of the skills that you have developed as a Project Manager in order to ensure that your project will be a success.

In either of these two scenarios, they are more common whenever a company is attempting to bring a new facility on line that will complement an already existing facility that has proven to be very profitable. In this situation the entire project may be profit driven due to a strong domestic and/or global market, and timing is critical. Consequently, the schedule is of greater importance, and the overall cost of the project assumes lesser importance.

b. Indirect Representative

Perhaps you are a Project Manager from an outside engineering firm or an outside consulting firm with a strong track record for managing successful projects of the type for which you are being hired. In this instance your firm may be supplying the various engineering and design groups as well as other support groups for the project. In this situation you will be in a good position to “make things happen” because your firm’s reputation as well as its bottom line are at stake. In this case the communication barriers are not as cumbersome and the potential rewards are greater. However, the risks can also be greater. Your deliverables are expected to be on time and your billings should be in line with your preliminary estimates. Here again you will probably be dealing with a Matrix organization, and your choice for key personnel to become a part of your project team may not necessarily be the

choice of your supervision. In this scenario the pressure by your Client to perform may be greater, although your lines of communication may be easier and more direct.

There may be occasions, as an alternative to the above scenario, where you may be a private consultant who is being hired as a Project Manager. In this case you have no direct or indirect affiliation to either the Client or the firm or firms being retained to supply necessary personnel. In this scenario the burden will fall entirely on you to maintain closer communications with all pertinent groups, to quickly ascertain and report any variations from the norm, and to assure your Client that the project will still be on time and within budget. You will necessarily have to spend more time with the engineering firm and its lead managers to keep their engineering and design groups on track and to avoid their wasting time and money on questionable issues that don't bring positive results. There are two ways to do this, particularly in the formative stages of engineering and design: (1) schedule weekly meetings with the lead managers and group leaders, again at a set time for no more than one hour, and utilize a printed agenda as often as possible. If circumstances prevent you from attending the meeting, notify the firm immediately and offer an alternate time and date for another meeting. (2) maintain a small office at the firm or firms where you can receive and answer questions as well as resolve any problems or issues on a regular basis. This simple but highly personal action should keep your project moving in the right direction.

4. Motivational Skills

Whether you are an in-house or outside (contracted) Project Manager, and irrespective of your affiliation with the various project groups and personnel who are assisting with your project, you must be able to motivate the individuals and/or the supervisors involved. In general, this means that the Project Manager must stay positive throughout the project, maintaining a strong personal discipline, and avoiding any negativity. A negative attitude which would illustrate a lack of discipline might include such incidents as browbeating, entering into short-tempered arguments, or – worst case – telling on someone or calling that person out in front of peers and/or supervisors.

The quickest way to lose the respect and control of your project group and, ultimately, your Client is to perform in an immature manner. Should you have a

disagreement with an individual over a performance failure that is egregious enough to get your attention, plan to meet with that individual and his/her supervisor, keep the meeting confidential but cordial, and maintain an open mind. You may determine that your concern was misplaced or, conversely, that there was a complete misunderstanding by the individual of your intentions. Resolve the issue at the meeting without creating any ill will or rancor. Should your concern be serious enough in your opinion to jeopardize the project and to warrant replacement of personnel, discuss that issue in a separate meeting with the group leader and/or your Client representative.

a. Maintain Unity

Some things that will aide your situation in this regard include the following:

- a. Communicate on an individual basis
- b. Answer their questions as concisely as possible
- c. Promise to get the answer if you don't have it readibly available
- d. Be willing to look at options and alternatives
- e. Be prepared to give a project update to any and all
- f. Hold short meetings as frequently as necessary
- g. Show an interest, no matter how large or how trivial the topic
- h. Avoid minor controversies and be prepared to make decisions
- i. Be positive and upbeat and never be critical of the company

Nearly all of these fall into the category of maintaining a good line of communications with all involved parties, from the Client to the last draftsman. **Never assume understanding that has not been explicitly verified; never take anything for granted!** There is the story of the national furniture company that had developed a revolutionary design for an ergonomic stackable chair. They retained a project manager in Alabama to oversee the manufacture of a prototype chair, and to then assist them in bringing the chair to market. The prototype was shipped to a manufacturing facility in Taiwan, where about 200 of the chairs were to be manufactured as marketing and sales demos.

A few weeks later the Project Manager and the Client's VP traveled to Taiwan to view the results of the two hundred chairs that had been quickly manufactured. The chairs looked great, the chrome-plated chair frames were perfectly formed, and the chairs stacked very neatly and compactly. They were even more comfortable than the furniture company had expected. There was just a small problem: where the original seat and back of the prototype had been processed, the polyethylene

injection port had left a hole in each part about the size of a quarter. The Taiwan manufacturer, being an expert in copying American products, had copied each piece exactly as it had been received, which naturally included the holes. The PM learned a valuable, but costly, lesson that day. As the PM, you must take the time to assure that all project team members are aligned with the same mission-critical details.

b. Maintain Integrity

Your performance as a person of character, accepting the responsibility of your position and avoiding any backstabbing will gain your respect and reward you with a more loyal project group. There will likely be occasions when situations will occur which you had not planned, potentially costing your project time and money. There is even the likelihood that your client has become aware of the situation and is critical of your performance. The common approach by a consternated project manager might be to voice your criticism and to blame others. While some of this may be justified, you risk losing your project team's confidence in you if the situation is not properly managed.

Your course of action in a situation of this type is to determine what went wrong, accept responsibility, apologize to your client and/or respective management, and assure all parties that the situation will not occur again. That will be a good beginning to restoring the confidence that was placed in you, but the conclusion will be your follow up actions in quickly resolving the problem. While actions of this type understandably require a great deal of discipline, the amount of respect that a Project Manager will receive following an incident of this type is immeasurable.

c. Strive for Excellence

There has probably never been a perfect project, and in spite of all your training and experience, your chances of becoming the first Project Manager to manage a project in such a manner are remote. There was a great football coach more than fifty years ago who told his professional team to "...strive for perfection every day. You will never become perfect, but you will achieve excellence." He instilled this thought in his players so often that they came to believe his words. And they did achieve excellence, five times over an eight-year period.

In case you hadn't heard this story before, the coach was Vince Lombardi and the players that he was talking to were the Green Bay Packers, including Hall of Fame Quarterback Bart Starr. The year before Mr. Lombardi arrived in Green Bay, the

Packers won one game and were about to lose their franchise. Mr. Starr was a last round draft choice (in those days the National Football League had a seventeen round draft) and a third string quarterback on that one-win team. Three years later the Packers won the National Football League championship. They went on to win four more NFL championships, including the first two Super Bowls. Mr. Starr was named the Most Valuable Player in Super Bowls I and II. Mr. Starr along with several of his teammates from that one-win team are now in the NFL Hall of Fame. Mr. Lombardi is also in the NFL Hall of Fame, and the Super Bowl trophy is named in his honor.

The correlation between playing a football game and managing a project is similar in many respects. The Owner/General Manager/Head Coach represents the Company/Organization/Client that provides you with the stadium and the uniforms to play in, the pads and helmets to protect you, the finances to see you through to completion of the game and the season. You are the Project Manager, the quarterback, the 17th round draft choice, who was selected by the Head Coach to lead the team, your Project Team. You may have experienced some success at another level, but now you are being asked to call the plays and lead your team to victory in the big leagues. Even though you have been given a “game plan” by executive management, you will have to overcome setbacks and use your options (ingenuity) to achieve victory (success). You may not win the Super Bowl, or even every game that you play, but everyone should have the confidence in you that the project will end in a victory.

B. Direct Project Responsibilities and Functions

1. Scope of Work

a. Understanding Client Requirements and Goals

Congratulations! You have just been assigned as the Project Manager for one of your/that company’s most important projects. Your Boss/Client has chosen you over other PM’s due to your track record, which includes past performances, character, experience, training, and intangibles that seemed to make you most suitable for the leadership position.

Now, however, your first personal objective is to meet with the Boss/Client and his closest aides to determine precisely what they hope to accomplish with your project. Perhaps they have preliminary drawings or sketches, have chosen a tentative location for the new project, and have received a commitment for the maximum funding necessary to implement and complete a successful project. This early stage of the project is extremely important to understand their long-term goal, and requires your experience and training in interrogation, discussion of options, and precise note-taking.

At this initial meeting you will learn several peripheral things that will have an indirect consequence on the success of the project:

1. A general description of the project as seen by executive management
2. The company's expectations when the project is completed
3. The person to whom you will report directly, and your personal lines of communication with other management members
4. The frequency and agenda of meetings to update executive management
5. The context, frequency and mailing lists of progress reports
6. Relationships that the company has with various sister companies, suppliers, and contractors

Pay very special attention to this latter item because you, as the project manager, are in the very unique position of either fortifying these relationships or else creating unnecessary problems for the company and its management. Not only are you obligated to have a close and honest relationship with the Client Representative, but you will be well served to develop similar relationships with any personnel who will be directly responsible for implementing the project (the project team) and operating the facility once it is into the startup phase. They may have the critical experience, and even some key personnel contacts, that will provide you with worthwhile guidance along the way. This is not to say that you will not have any options to perform your duties in an objective manner, but only to prepare you further to justify any of the options where management and operations might have a particularly strong interest.

b. Assignments and Communications

You might have noticed that nowhere in the six items above is there any mention of Scope of Work. That is because quality management should be

explaining to you **what** they want you to accomplish but not **how** they expect you to accomplish it. The company management has given you as the Project Manager most of the information necessary for you to develop the Scope of the project and this is your responsibility. Depending on the size and complexity of the project, and even though you may have enough familiarity with the facility to form an outline of the Scope, this is usually a major task and will require support and input by others. Thus your next objective, and arguably your most important other than understanding what your Client expects to accomplish, is the gathering of personnel that can best assist you in achieving your ultimate goal. Each person, whether selected by you or offered to you, represents a candidate that can determine success or failure. While this phase of building the project team is critical, it is also quite subjective.

In building your team, you should be looking for those personnel that have the same characteristics, but not necessarily the same personality, as you. While you may be seeking a team member that is determined and dedicated as well as competent, you really don't need any "Yes men or women". Conversely, your team members must be flexible and not stiff-necked or argumentative. Team member should be given the opportunity by a Project Manager to express their alternative viewpoints, which the PM will be receptive to hearing. Nevertheless, every team member must understand that you are the decision maker and you will have the final word regarding any controversy. At a very early stage in the project you will develop discernment for whose ideas and concepts you are willing to accept without too much discussion. You cannot expect to micromanage any aspect of the project, so you must quickly determine which team members you can implicitly trust and which of them will try to fleece you when they can. Always be prepared to reprimand a team member (in private) or to have a non-performer or a troublemaker replaced.

With this phase of the project firmly in hand, you will now begin to develop a basic outline that should include the following:

1. Location of the facility
2. Environmental requirements
3. Design criteria
4. Equipment purchases
5. Needs of construction, including special applications
6. Individual component and system testing
7. Punch lists, startup and optimum operations
8. Project closing

Whether or not the Project Manager has an official Project Team within his/her direct supervision, the PM is responsible for the assignment of project responsibilities. This implies that the PM will determine which groups, but not necessarily which individual, will be responsible for each phase of the project. For instance the PM will determine the method for designing the project: whether to use in-house engineering services, if available, our outside sources if not. In some cases, depending on the time constraints and or the budget available, a combination of the two resources may be justified.

In another instance selection of procurement services is equally critical. The purchasing group must have the same sense of awareness as the PM, and must be sensitive to the overall objectives of the Client. Essentially every step of the project must be preplanned by the PM to the extent that each responsible member of the project team has a clear understanding of the duties and timeline required.

c. Communicating with Executive Management

On nearly every project with which you become involved, you will have at least one person who will become your Project Mentor. These individuals may be in positions of executive management, may be persons who have gained valuable experience working with the company and/or clients, and may have even been successful project managers. You as the project manager should regularly communicate with these individuals and welcome the supervision they provide. Your functioning as a PM is incomplete without them. Consider this to be an obligation.

There are many ways to accomplish this obligation in today's age of media coverage. Telephone calls are a quick and easy method of communicating, although your list of call recipients must always be approved by your immediate client representative. Even if you receive a direct phone call from someone high in the organization, take any message and clear your response with your Project Mentor. If your Mentor is not available, return the call as soon as possible, preparing your response in a totally truthful manner. Remembering the truth is a lot easier than remembering a half-truth or an outright fabrication. Once you have reached your Mentor, explain your reasoning for temporarily bypassing him or her.

The use of emails is another excellent method of communicating with the members of your project team as well as with your client and executive management. In this case the same rule applies; even if you receive a direct email from someone high in the organization, clear your response with your Project Mentor. If your Mentor is not available, return your email response as quickly as possible, preparing your response in a totally truthful manner, copying your Mentor on any correspondence.

d. Preparing Executive Summaries

One of your primary functions as “the” Project Manager is to keep your project team, your Client and your Client’s management informed of the progress of the project. Your responsibility is to perform this task as detailed as necessary, but as succinctly as possible. Keep in mind that a report of this type is not meant to be an opinion piece, but rather a fact document. If you are asked to give your opinion on a project matter, do it verbally, but don’t put it in writing if you can avoid doing so. There are various means to maintain a good line of communications with your client as well as with the various leaders of your project team.

One example of this format is a weekly Project Memo update, which can be patterned after your project schedule. In this type of format, the PM prepares a weekly summary of activities that reflect the progression of the project as it occurs, citing such aspects as the progress being made in specific operational areas and the problems being encountered. A memo of this type will carry more weight with management if it is first reviewed and then signed off by both the Project Manager and the Client Representative. The PM should also include various notes that incorporate features such as safety and environmental issues. This type of Memo should also include updates from the previous three or four weeks to indicate the level of progress as well as to illustrate any problem areas that may or may not have been resolved.

Another method which has found favor in recent years is the creation of a website dedicated strictly to a specific project. This type of format, while being somewhat more complicated, is generally reserved for larger projects. The initial setup will be more expensive, but the actual maintenance of the site will be relatively inexpensive. The progress of a project can be updated literally every day with input from different key personnel who are members of the project team. In general the team members have a “write only” capability, and don’t necessarily have the option of viewing parts of the project which are not

considered their responsibility. Executive management, which is usually described as any member of management that has a vested interest in the progress of the project, will be equipped with a password and “read only” capability, and will have the option of viewing any or all parts of the project for which they have a concern. The Project Manager has the ability to analyze and override any issue on the site which might be considered inaccurate, or even to some degree disruptive, to the overall benefit of the project.

2. Developing a Budget

About half of the time a Project Manager is involved in a project early enough to have some meaningful input into the overall project estimate and its subsequent appropriation request. Just as often company management (the Client) has established the approximate amount of money that its Board of Directors will approve, and has already submitted its request for funds. In the former case the PM will have a Scope of Work with a Budget that can be fine tuned. In the latter case the PM will have to assemble a Budget from the very beginning, but will have to be very careful and meticulous not to change the appropriation in any significant manner from what has been presented to the Board.

In either situation the PM must develop a preliminary spreadsheet that can illustrate, primarily to the PM’s Client Representative, what the estimated cost of the project will be. There are likely several ways to provide this information, but the simplest and most effective means is to use an Excel format. With this program you can use the vertical column to list all items and functions of the project, normally utilizing no more than a few pages on 11” x 17” sheets of paper. Across the horizontal row of the Excel spreadsheet, you can list your timeline, whether in weeks or months. A spreadsheet of this type on one or two sheets of 11” by 17” paper is usually satisfactory for no more than a twelve month schedule, while a larger project using a similar arrangement on 11” by 17” will usually cover twenty-four months, but might require several more pages. Expenditures for each month can be summarized at the bottom of the spreadsheet, and total costs for each line item can be summarized at the right hand side of the spreadsheet.

Should the budget estimate prove to be more than what management expects or appropriates, measures will have to be taken by the PM to reduce the Budget by streamlining or reducing the Scope of Work until management is satisfied with the revised budget. The alternative, of course, is for the PM to reduce the

timeline and postpone unnecessary auxiliary facilities until a later date when sufficient funds may be available from the company. In either situation the PM must have detailed knowledge of both the estimated cost and the schedule requirements.

Your budget may begin with a land purchase or lease, include an environmental study, and possibly a new road or a railroad track extension. The estimate should include engineering fees, equipment costs and shipping (always attempt to keep shipping costs separate, as this is not a capital expense), utility requirements, construction costs, supervision of erection, and travel costs for members of the project team. Included in construction costs will be such items as trailer rentals and setup, utility fees, sanitation, field office staffing, and possibly new roadways and access ways.

Know Your Facts – Don't Guess

During preparation of a budget estimate, the Project Manager will have to make calculated estimates rather than simply guessing. For instance engineering fees can usually be determined as a percentage of the total project cost. Equipment costs can be determined by a review of similar projects and/or by the use of judicious research and phone calls. The PM can estimate the majority of construction costs by using the same criteria that contractors develop when preparing their bids: volume of concrete and weight of steel versus cost per square foot for main, auxiliary and office buildings; weight of equipment to establish rigging and erection costs; lengths and sizes of piping that an M&P contractor would estimate; and equipment, conduit, trays and cable that an electrical contractor would require. Inasmuch as this would be a budget estimate, the PM should consider a much higher contingency factor, possibly as high as 12 to 15 percent.

There are also several factors which most Project Managers include in their estimate to cover variable project costs that will occur as the project proceeds. The first of these is called "design changes", which applies to almost any equipment in your project. This could simply mean that the old version is obsolete, and the new version is faster, has more modern controls, and will give you a higher production rate. On the other hand the manufacturer may not have made any significant changes or improvements, and simply had a price increase with the intent of passing that increase to the buyer.

Another obvious factor to consider is the cost of living increase, which requires the PM to utilize a forward escalation feature in the project estimate. This factor will apply to virtually every item in the budget estimate, and which will vary somewhat depending on the overall length of the project. Since this is a time-sensitive factor, a prudent PM and the project team members will seek commitments from as many potential suppliers and contractors as possible. One specific example of this would be to solicit firm unit prices for building foundations and steel supply as well as placement and erection.

A third factor to consider and include in your project estimate is defined by most projects as “contingency”. This number is usually a fixed percentage of the total cost of all other items in the estimate, and depending on the complexity of the project, can vary from as low as 2.5 to 3.0 percent all the way up to 7.0 or 8.0 percent. However, a well defined and well planned project should never have a contingency factor greater than 4.0 percent. Although construction costs are often more difficult to estimate and project, these estimated expenditures must be included as you develop your forward escalation and contingency costs.

3. Scheduling – Time vs. Costs

The two most important aspects of any project, other than to assure the Owner of the prospects for getting it right, are schedule and budget. A competent Project Manager will always weigh these two variables on a daily basis in order to ascertain whether or not he/she is providing a truly valuable service to the Client(s). This is never an easy task for anyone, and often creates much controversy within the project ranks. However, you are hopefully being paid well for your services and should never be in doubt as to your ultimate goal.

Regarding your responsibility to meet your Client’s schedule, the objectives of nearly every project are to complete the project within a certain time frame and to have a financial reserve available for startup and any emergencies. On the surface this may appear to be a routine matter, but often becomes difficult and, at times, nearly impossible. However, a competent Project Manager should be capable of creating and maintaining a quality schedule by using some basic tools. If you can quickly master the fundamentals of Microsoft Project, you will be able to provide a schedule that utilizes a Gantt Chart, and can keep you and the Client current with the tasks and activities involved. As you grasp the nuances of MS

Project, your ability to furnish additional details, and to even prepare a critical path for your project, will greatly improve.

In the event of larger projects, such as those that might easily exceed \$50 million to \$75 million, there will likely be a need for the you and the Client to hire personnel from outside firms to provide such schedules as Primavera or Timberline in order to provide more specific details. Always keep in mind that the personnel doing those types of schedules would be looking to you and your project team to provide them with the necessary general details. Thus your ability to understand the basics of scheduling and to quickly grasp the fundamentals of your scheduling team, if required, is exceedingly important.

Where to Start

There are several important factors to consider when preparing a schedule. One factor that is not always obvious is to start with the end date. If your Client or Customer has a completion date as the target, use that as your end date, allowing the necessary time for punch list items, equipment startup and system startup. Unless you are dealing with a Federal government project, you are almost always under some schedule deadline. With each of these “end- of-the- project” factors, include sufficient float time as contingencies in the event of significant delays. As you work your way back on your MS Project schedule, follow the same principle of allowing sufficient float time toward each category. The chances are reasonably good that you will have used excessive float time throughout your schedule. In that event first look at items where you feel certain that float time can be either reduced or eliminated. Next look at items in which time is established by you and your project team, such as the time allotted for receiving bids or the time allotted for placing contracts.

Scheduling Is a Process

Establishing a viable schedule is a process that will take several iterations. The main fact to consider when finalizing any initial MS Project schedule is to have most of your float time toward the end. This is when enthusiasm wanes and tedium sets in, or as one infamous sage once commented, “...unforeseen variables occur.” During the formation of your MSP schedule, one of your first duties is to provide a separate list of all the equipment that you and/or your team will be required to purchase for the project. Once this list is issued, you can meet with your engineering group to assign priorities for preparing specifications, requests for quotations or proposals, and bidders. Needless to say, the longer lead time items and more complex installation will require higher priorities and, ultimately, greater float times in your project schedule.

Include in the equipment list the various vendors who will be bidding, your estimated or budget prices, their pricing and delivery schedule, as well as your estimate and theirs of how long the installation will take. With regard to vendor delivery dates, you must allow a certain amount of float time in your schedule to accommodate any variables that might occur. The higher the complexity of the equipment that is being purchased, the greater amount of float time should be considered. Also, the same general formula applies to equipment being purchased overseas; leave ample time for ocean freight, clearing customs and the port of entry, and overland freight to the project site.

Once you have decided on your major equipment and have placed your purchase orders, you now have the basis for a quality MS Project schedule. You can evaluate the delivery times of the major items and how those dates coincide with your estimates for installation in order to determine which critical path items will need to be expedited. You will also be able to determine other critical issues such as which equipment items you can schedule as “early start” and which items will have a later start date. Regarding any equipment with a long lead time delivery, the PM and the project team may have anticipated a later delivery date. If that were not the case, then you should consider the reduction in float time for that item and/or the utilization of specifically targeted construction overtime for that equipment.

If you and your engineering firm have properly coordinated your project activities, the engineer will be receiving vendor drawings in a timely manner so that the construction drawings can be produced as quickly as possible without overloading the engineers. In an ideal project the release of construction drawings will occur in a manner consistent with product flow. However, that situation rarely occurs, so that there are two main procedures to concentrate on at this point. First, be certain that your engineer has enough time to produce accurate, if not total quality, construction drawings. Failure to do so will prove to be costly as well as time-consuming. Do not permit the constructor to begin his work utilizing preliminary drawings unless you, personally, have reviewed them for reasonable accuracy. After all, you as the PM are the only one responsible for both cost and schedule. Initiate your utility specifications with your engineering group, making them especially aware of any unusual requirements. At the same time your engineering group will be preparing construction specifications and you will be furnishing them with a list of experienced contractors from which to solicit bids.

Second, and equally important, is the necessity to establish the sequence of your project tasks, which is the next to last step before preparing your project schedule for general publication. This involves a beginning point, which might include such items as choosing a site for the project, securing environmental permits, selecting an engineering firm, and even receiving financial approval of overall costs and ROI (Return on Investment) for the project. In today's world of restrictions and regulations, your chances of successfully maintaining a project schedule will depend on the ability of the Project Manager to multi-task. This simply means that, once the project has been approved and funded, the PM must have a mindset to move forward in as many areas as possible without waiting for all documents to be formally signed and delivered.

Still a Moving Target

Finally, as you begin to incorporate each function into your project schedule, you should now have a fairly concise idea regarding the duration of each task. Keep in mind that at this point everything is still on paper, and nothing is yet cast in stone. You can still alter either the sequence or the duration of each task to best suit your end result. Overlap functions where necessary, avoid unnecessary duplications, and minimize movements by all parties so that projected costs are within your limits. This MS Project schedule now also becomes a useful tool for verifying your project budget by assuring that all items are covered.

Once you as the Project Manager have a viable schedule with which to work, bear in mind that it will probably change every week until the project is concluded. Most of these changes can be managed by the Project Manager in a fairly routine manner. However, there will be a few occasions during the course of the project when you may have to make a decision which could alter not only the time frame but also the end date of the project's completion. In such cases the PM must know how each day's delay will affect the Company's future as well as current bottom line. For such an eventuality there is a general **rule of thumb** that can be applied by the PM, commonly known as the **60 Percent Rule**. This rule implies that if the potential cost of the delay should exceed 60% of the project's loss in profits over the same time period, then the PM should seriously consider making the expense necessary to correct any lost time in the schedule.

For instance, you may have been made aware by the Client that each day of project delay will cost the Company \$10,000 in lost revenue, or approximately \$1,000 in lost profits. You then learn that a critical piece of equipment is being

shipped by general freight, which is included in the supplier's contract and will take a delivery time of one week longer than expected. However, if you ship the equipment by "exclusive use of truck", the equipment will arrive on site in four days at an added cost of \$1,500. If your analysis is that the site contractor is ready to install this critical equipment the moment that it arrives and that the extra three days of shipping could jeopardize the project completion date, then you are justified by your decision to spend the extra \$1,500. In this case the rule of thumb is being applied, because you are spending \$1,500 to save the company a total of \$3,000, or about 50%. However, you might have several options at this point in the project. Quite likely the project team had inspected the equipment at the supplier's manufacturing facility and the PM may feel confident that the installation will go smoothly. In the meanwhile you may have had your electrical contractors and your process control engineers perform sufficient preliminary work so that, when the equipment does arrive and is installed, the time saved in startup will offset the late delivery time. Finally, by closely tracking the shipping routes and transfer depots, you may be able to expedite the actual delivery date of the equipment, thus reducing the actual shipping time by one or more days.

Suppose that in another situation you have a site contractor that is demanding a 12-hour workday (ten hours has been the normal workday) and a 6-day work week (five days has been the normal work week) in order to complete a particularly critical phase of the project. If your analysis is that the overtime cost will be an additional \$3,900, but the project schedule will benefit by five days (or \$5,000), then you might want to consider this expenditure as unnecessary since it exceeds the 60% rule. In a case like this, nevertheless, the Project Manager must look at the impact of being possibly five days late with the project, reevaluate activities that can be scheduled concurrently, and look for other ways that can bring the project to completion on the original date. In any event entering into communication with your Client and Construction Manager as soon as you are made aware of the problem is essential. Having the Client involved when you are in a situation that might delay the final completion date of the project is imperative; management might shed some light on a little known facet of the project that might change your approach. The Construction Manager, on the other hand, may be able to offer an alternative to overtime, such as simplifying the task, or even completing the majority of that particular phase after startup. Even though the final decision rests with the Project Manager, the PM should never be afraid to look for some guidance. In general, the prudent use of overtime can benefit the project for a myriad of reasons which will be

discussed later in this article. On the other hand, abusive use of overtime can be detrimental to any project.

4. Engineering and Design

Whether the design for the project is being developed by an in-house group or by a contracted engineering firm, the same “rules of engagement” apply. In the first situation you are dealing with what is termed as a Matrix Organization, in which you have no direct authority. Your main “weapons” are communications and motivation. Not only are you required by your position to communicate the philosophies of executive management, but you are also obligated to deal with the individual design managers and design leaders in a forthright and truthful manner. In the second instance, you are working with a Captive Organization which is under contract to provide the necessary deliverables in a timely manner. Nevertheless, your obligations and objectives remain the same, even though your personal influence may be somewhat greater.

In either case the personnel that are working on your project may be working on two or more other projects, have their own priorities, and need to plan their activities and work schedules accordingly. You should be meeting with the design leaders who are directly involved with your project on a weekly basis, giving them a summary of the MS Project Schedule for the items that are to be accomplished by them. These meetings should be brief (less than one hour) and should be agenda-driven. Design associated with site work and buildings, followed as closely as possible by packages for equipment design, should initially take precedence over construction bid packages. Although this latter item is ultimately important, a major factor in project cost overruns occurs when a constructor is in standby, waiting for equipment to be delivered.

The design functions of the engineering group that are an integral part of your project team are comprised of three major deliverables as well as a general support function:

- a. General arrangements and layouts of the facilities
- b. Design bid packages and specifications for equipment
- c. Design bid packages and specifications for construction
- d. Other general support functions

These functions are more specifically described in the following sections:

a. General Arrangements and Layouts of the Facilities

In the case of item a) above, the initial drawings must necessarily be preliminary, mostly based on the experience and knowledge of the Project Manager, the Client, and the design team. This particular portion is actually comprised of three separate areas of design, none of which are in a perfect sequence for construction:

- i. The first construction item is usually the building or buildings, but they can't be properly sized and designed until the equipment is sized and laid out in an orderly manner. This will include walkways, traffic and equipment accesses, office space, and restrooms among other items. The risk in not having most, if not all, of the critical equipment dimensions is that the building (s) will be too small or too large, both of which are costly propositions.
- ii. The second construction item includes the utility requirements such as sub-stations, air compressors, HVAC equipment, and climate controlled buildings. Some of the utilities would be underground, and some would be overhead. Some, such as an electrical sub-station, switchgear, and/or a computer or control room would require large areas as well as strategic positioning.
- iii. Finally, construction drawings for all the process equipment will have to be developed. At this point your engineering team has allowed for such mandatory design features as maintenance access and overhead clearances.

Should building design or utility design begin without some significant equipment information, the same practice of either under designing or over designing becomes a real threat to the project cost. Other than calling on the experiences and knowledge of the Project Team, the first option for gathering this data is to search within the company for similar facilities. If this new facility is to replicate an existing one in some manner, the time the project team will take inspecting and observing those operations will be time well spent.

Another ethical solution to this dilemma would be to engage suppliers of critical equipment for assistance. The Project Manager and the Client may have a clear understanding of the type of equipment needed, and might even have a recommended list of suppliers' names. Most equipment suppliers should be willing to recommend

visitations to existing facilities in other companies where their equipment is being operated. Under normal circumstances those suppliers would make the necessary arrangements for those visits, and also would accompany the PM and team members on those visits. A third option, if all else fails, is to request that any two legitimate vendors who will likely be on the bidders' list submit non-binding and non-proprietary proposals for their equipment that would include basic dimensions and utility requirements. These solicitations would probably occur with no more than a verbal or one-page specification, and should be handled by the Purchasing Department under the authority and direction of the Project Manager

General arrangements and various layout drawings, as well as critical sections through those layout drawings, are the lifeblood of most industrial and commercial projects. Even where architectural drawings may have a more significant role, arrangement and layout drawings will be used to signify the overall footprint of the facility and to provide guidelines for planning and developing the project. This phase of the project is often tedious and is slower to develop than many Project Managers seem willing to tolerate. One method for accelerating this process, depending on the overall size and schedule of the project, is to divide the master general arrangement into multiple plan views. These plan views can be connected by means of "match lines" and/or "match markings" which identify their locations on the arrangement drawing. These individual plan views can then be developed separately. The obvious advantage is that each plan view can be assigned to a different designer or design group, thus expediting this phase of the engineering function and effectively providing the PM with a better quality product. Although the ultimate responsibility for sizing the equipment and determining the specific requirements of these arrangements lies with the engineering group, the support of the PM in this effort cannot be underestimated.

b. Design bid packages and specifications for equipment

Given the above information, the engineering group must now put forth a strong effort to develop the necessary bid packages for the critical process and utility equipment (item b above). Having already received a substantial amount of preliminary information for this equipment, they should be able to provide the necessary bid packages, including specifications, in an expeditious manner. In addition the payment terms and the legal structure of the pending contract are usually a combined effort involving legal, purchasing, finance, and project management. An important aspect of the engineering group is securing supplier drawings for use in

finalizing facility design as well as providing those drawings as references in the construction bid packages.

As previously noted, finalizing building design is a formidable task when equipment dimensions and utility requirements are not completely known. In those situations the Project Manager should be more inclined to advise his engineering team to go larger rather than smaller. Your experience as a PM has probably illustrated to you in other projects that a project rarely has too much building to spare. The cost per square foot of buildings in the primary bidding stages is usually less than 75% of the cost for an add-on once the building contract has been let, and usually less than 50% of the cost for an add-on once the building is erected.

c. Design bid packages and specifications for construction

Bid packages for construction (item c above) follow the same guidelines as equipment bid packages, using final layout drawings and suppliers' drawings as references. Payment terms and specifications are a joint effort of several groups, including legal, purchasing, finance, and project management. Scheduling of field activities must remain as a unified effort of the Construction Manager and the Project Manager.

Having the equipment suppliers submit their certified drawings requires a concerted effort of an experienced Project Manager as well as the project team. The suppliers that submit certified drawings of their equipment per a contractual date are not usually in the majority. On most projects, and especially on fast-track projects where the construction contractor may be on a time and material contract, the schedule for certified drawings is just as important and unique as equipment deliveries.

d. Other Functions of the Engineering Group

In addition to these major functions, an experienced engineering group will also provide expediting of equipment drawings, inspection and quality control of equipment drawings that are received, and assistance in resolution of problems that may occur when a contractor discovers a discrepancy in the equipment during installation. These items will be discussed later in this section, but the three core functions listed above are described in more detail as follows. As mentioned earlier in this section, there are several auxiliary functions listed below which a Project Manager should demand of a professional engineering group:

- i. Inspection and quality control of equipment drawings - once a firm contract has been let to a supplier, the engineering group has the responsibility to thoroughly review that supplier's drawings to determine whether the equipment is being manufactured according to design and specifications. In the event that the drawings are not conclusive, a visual inspection of the equipment would also be warranted, and should include the determination that materials such as metals and wiring, and manufacturing practices such as welding and machining meet necessary quality requirements and standards of the project specifications.
- ii. Assistance in resolution of problems that may occur – during the course of regular supplier drawing reviews, specific visits to the suppliers may be necessary. These are generally scheduled by the Project Manager in order to optimize costs and benefits. Any problem areas should be noted in writing and resolved immediately at the manufacturing site. Otherwise an open or contested problem should be communicated to the Project Manager for analysis and resolution.
- iii. Expediting of equipment drawings – unfortunately, most first-time Project Managers have learned that, unless there is a well-defined incentive clause in the contract, a supplier will often be late with a scheduled delivery of equipment drawings. Thus the engineering group provides a valuable service by recording manufacturing drawing status and expected delivery dates after each supplier phone call or email, and issuing written status reports. Although the PM may make an occasional supplier visit, reliance on the engineering group for this information is imperative.
- iv. Inspection and quality control of installation - once a firm contract has been let to a site contractor, the engineering group has the responsibility to visit that site to determine whether the equipment is being installed according to specifications. Inspection of the construction site should also include the determination that materials such as welding rods, fasteners, piping and wiring meet necessary quality requirements and standards of the project.

All of these above listed activities which are being delegated to the engineering group do not abrogate them from being the ultimate responsibility of the Project Manager. A quality PM is expected to know and understand the generalities, if not the specifics, of the layout better than any designer. Most PM's will make a concerted effort to visit facilities that are manufacturing critical equipment, particularly if that equipment is on the critical path schedule, and form an opinion of the quality of manufacturing and the timeliness of deliveries. A PM's most important role during the formative stages of design as well as with the ongoing manufacturing is to make the necessary decisions that will keep the project moving without delays. Decision making in the early and middle stages of a project will help to relieve some of the pressure from the late stages of the project and minimize or altogether eliminate panic decisions.

5. Procurement

Once your various equipment bid packages have been prepared, you are now ready to work with the Procurement, or Purchasing, Group. They, along with the Client Representative and your Design Leaders, shall have collaborated at your request to form a bidders' list that will meet the project requirements of specifications, cost, and delivery. As the PM you (and your Client), based on past experiences, should retain the right to recommend other bidders or override the selection of any suppliers on those lists with whom you may have had bad experiences, or otherwise may not be qualified in your opinion. However, you must stay objective in this regard, because you are working with other Professionals in this area who may or may not have more experience than you.

There are many factors to be considered while working with a Purchasing Agent, and even an entire Purchasing Department, especially when the time comes for their direct involvement. In the initial phase, which involves the preparation of bidders' lists, your Client, your engineers and you will have the primary responsibility in the selection process. Someone in the Purchasing group may have a preference for including a particular supplier on the list. As long as you are satisfied that the supplier will meet your technical requirements and standards, including that supplier should not be an issue. This should be the normal method of engaging suppliers, regardless of whether the item is large and significant or not.

Once the design packages have been issued to the listed suppliers, bid due dates have been established according to your project schedule, and proposals have been received, there is sometimes a lack of harmony in the final supplier selection process. The Purchasing Group has a set of guidelines that may require them to award a contract to the low bidder. You and your engineers may determine that the product being offered by the low bidder is technically unacceptable. Your Client may prefer one of the higher bidders. For you as the Project Manager, the time has come to put on display your skills and experience as well as your integrity, emphasizing as objectively as possible your reasoning for selecting the **low, technically acceptable bidder**. By maintaining your objectivity, which might include a series of supplier meetings whereby all interested and dissenting parties are invited to ask questions and to listen to the answers, you will minimize any discord within your project team.

As a further note, your project is too important to accept a promise from a supplier that has never met your particular criteria. Maybe that supplier should not have been on the bidders' list in the first place, but you and your team were fortunate to have learned of the deficiency before a contract was signed. In addition, and irrespective of the successful suppliers' credentials. You will be wise to insert a performance-based retention clause in all significant contracts. This retention usually amounts to a 10% retention on the total contract, not including shipping charges, which are normally negotiated and paid separately. A very important element for the Project Manager to maintain is to ensure that the supplier is paid per the terms of the contract as soon as the project team has accepted the equipment.

Purchase Order Follow Up

After the Purchasing Group has issued a purchase order to a supplier, they are often the group that assists the Project Manager by expediting the supplier and maintaining the original intent of the project schedule. An experienced PM can usually acknowledge that Purchasing has a certain amount of "clout" with suppliers, which often means that those suppliers perform to the best of their ability when the Purchasing Group engages them. Another "friend" of the Project Manager is your Client's Legal Group, which probably assisted in developing the terms and conditions of the various suppliers' contracts. This is particularly true in the event that a penalty-bonus clause has been established in any of the supplier contracts.

In a similar manner your various construction bid packages will be prepared according to your project schedule, and you are now ready to work with the Purchasing Group to select contractors that will perform the field construction. Purchasing along with your Design Leaders, Client, and Construction Manager shall have collaborated at your request to form a bidders' list that will meet the project requirements of specifications, cost, and completion dates. As the PM you (and your Client), based on past experiences, again retain the right to recommend other bidders or override the selection of any contractors on those lists. However, you again must maintain your objectivity as in the case with equipment suppliers, keeping in mind that other Professionals in this area may have more and/or different experiences than you.

Your options for this critical phase of the project are now quite different from the design and equipment phases of the project. If the project is large and ample funds have been allotted, then you may be better suited to be dealing with general contractors who have the capability to bring in a workforce and sub-contractors that will meet your schedule requirements. In a situation of this magnitude the Project Manager will almost certainly be assisted by one or more Project Engineers who will be given the responsibility for completion of specific site or operating areas. Conversely, the PM may determine that there is a limited budget and will have to work with several specialty contractors. In either case the burden on the PM can be considerable, depending on whether you are working with an experienced Construction Manager in whom you have confidence.

Regardless of your approach, your project efforts will become much more intense after the proposals have been received. As with the equipment proposals, rarely will you receive a proposal that does not elicit a series of objections and questions. The PM must have allotted time for issuing questionnaires and scheduling contractor meetings. At these meetings with all pertinent parties present, you will likely get a consensus of which proposals, whether or not they are the low bids, will offer the most value to the project from a cost and schedule stand-point. These contractor meetings should also be held consecutively whenever possible, occurring in the shortest window available. As with the supplier meetings, never schedule more than one company at a time, and prepare a list of questions which each contractor can review before the meeting.

After the Purchasing Group has issued a purchase order to a contractor, they should be kept in the loop of communication by the Project Manager. An

experienced PM can usually acknowledge that Purchasing has a certain amount of influence with contractors as well as suppliers, which gives those contractors the incentive to perform to the best of their ability. The same courtesy should also be extended to your Client's Legal Group, which probably assisted in developing the terms and conditions of the various construction contracts, especially in the event that a penalty-bonus clause has been established in any of the construction contracts.

6. Construction

Most projects of any significant size will usually have a construction manager who will be assigned to the Project Manager. This individual may be a company representative or may come from an engineering and/or construction firm. The CM should be hired early in the process, not only to help set up the project field offices but also because he or she should be a valuable resource for potential bidders. The CM should also be expected to develop an intimate knowledge of the project, especially the schedule, and will assist the PM with the site planning of the project.

As noted earlier, the design packages are to be prepared for release to the various construction bidders, and the PM and the procurement (purchasing) group should have collaborated with the Construction Manager in order to develop a construction bidders' list. Let's assume that, as a Project Manager, you have significant experience in dealing with construction companies in your fields of expertise. However, each project has its own nuances, and each geographic area may have its own set of valid constructors. If your project is quite large (\$100 million or more) and has a high degree of complexity, then your best interests may be served by engaging national construction firms that have served you in the past. Otherwise, your secondary objective in this situation is to stay in the background during the selection process for preparing the bidders' lists. Your primary objective is to evaluate each construction proposal in terms of safety programs, superintendents' experiences, manpower availability and schedule commitments. At some point during the evaluation process, best acceptable price may become an issue. If that number is over your budget, then you as the Project Manager will be required to work with your design group to bring the price in alignment with the budget. However, remember your assignment; the responsibility for negotiating the best final construction price lies with the Purchasing Department and not with the Project Manager.

Selection Process

There are several criteria besides lowest cost for selecting any major contractor and most sub-contractors for your project. Some of these include:

- a. Being aware of resource allocation. Choose construction companies that can multi-task, but your ultimate responsibility is to assure that none of the companies is over-burdened. Short (one hour or less) meetings with an agenda prior to contract placement to get specific answers to your timetable requirements should suffice to identify and address potential problems in this area.
- b. Determining the level of experience that a contractor might have with the same or similar type of project that you are implementing.
- c. Being certain to receive and review a resume of the contractors' superintendents who will be responsible for the onsite management.
- d. Being certain that any contractor that you might select will be willing to consider a penalty-Bonus clause in the terms and conditions of the final contract. While the clause may not be implemented, the contractors who are willing to accept this clause are at least demonstrating confidence in their superintendents and workforce.

While this latter item may seem to some of your project team or to some management members as unnecessary, a well crafted clause of this type will give you assurance that the contractors will give you their best efforts. And also remember that the courts have ruled that a company or organization cannot implement a penalty clause unless a corresponding bonus clause is also stipulated.

Placing a Design/Build contract with the same firm minimizes your ability to control the project. Most successful projects maintain engineering separate from construction. This is not to imply that the Project Manager should be looking for an adversarial relationship between the two entities, but rather that this simple procedure might enhance the competitive nature of the project toward a more

successful completion. In addition this tactic assures the Client that the PM has made a sound business decision by avoiding any appearance of a conflict of interest. Furthermore, an engineering firm will take a certain amount of pride during its inspection process in knowing that its design practices and standards are being met by the construction contractor, and that it has played a prominent role in the success of the project. Conversely, there will be a line of communication between the construction contractor and the engineering group in order to resolve minor discrepancies, without the necessity for involving either the PM or the CM.

An experienced PM will make the rounds of the jobsite at least twice a day, possibly with the Construction Manager in the a.m. to verify such items as workforce size, priorities, and progress. Resource leveling - the ability of the contractor(s) to provide a consistent, quality workforce for each critical phase of the project – may be one of the construction issues that might need to be addressed during this inspection. A tour of the facilities in the p.m. with a lead engineer might expose any problem areas which may necessitate some last minute design modifications. In any event the PM must be careful not to interrupt the work flow, but rather denote any potential problem areas that can be quickly resolved as well as to be in a good position to assist in developing the inevitable punch list.

7. Cost Control and Cost Correction

Larger projects may have a Cost Control Associate on site who is responsible to the PM. If that is the case, then you as the PM should expect this associate to provide a detailed report of the costs and expenses incurred on the project and to compare these costs against the original budget plus any financial additions or deductions that have been made. You, and undoubtedly your Client, should expect to receive these reports bi-weekly for the first 90% of the project's duration, and to receive at least updated mini-versions on a weekly basis during the last ten percent of the project.

Keeping a critical view of the project's costs are as important at the beginning of the project as they are in the latter stages. As an experienced PM, or even as a novice, you will recognize areas and functions whereby some items may be eliminated, some items will require a reallocation of funds from "known" savings elsewhere. Some equipment items which were either possibly overlooked, or

else had to be replaced by more expensive items in order to benefit the overall project, may just have to be funded out of contingency. While utilizing the Contingency Fund to cover project overages may be enticing, this fund should be used by the Project Manager only as a last resort. PM's need to regard this fund as a safety valve, to be used only in cases of absolute emergencies.

As your project becomes active and your original budget actually begins its conversion to collect current expenditures, the PM and Cost Control Associate will have to add some columns to the spreadsheet. The first additional column could be entitled "Expenditures to Date", which is a summation of actual expenditures by the company. This column will take into consideration the actual amount of funds expended to date (actual payroll for in-house personnel, checks written to suppliers, utilities, contractors, etc.). The financial factors in this column are usually occurring on a daily basis and should also include all travel and living expenses incurred for the project. One of the more significant features of this column is for the Project Manager and his/her Cost Control Associate to determine whether the rates of payments are in alignment with the company's funding of the project. For instance, if the project is completely funded, then the Cost Control team can save money by using a discount factor (usually 2%) in its payment terms. Conversely, if funding for the project is coming from recurring profits from operations, then the team might want to extend contractor and other payments to net thirty days, or even to net 45 days. Extending payments beyond these periods is not a good business practice and is not recommended.

A second additional column would be entitled "Required to Complete". This column should primarily reflect commitments, or promises, to fulfill existing contracts such as any retention being withheld, extra work accepted but not yet paid for, known freight charges not yet paid, used but unbilled payroll, and the like. Financial factors in this category are transferred into the "expenditures" column only as soon as an invoice has been paid by the company, regardless of whether the project team has approved payment.

A third additional column is referenced commonly as "Estimated to Complete." This column can sometimes become loaded with ambiguous numbers, but an experienced Project Manager can keep these financial factors realistic through erstwhile communications with all involved entities. This column might include such financial factors as incomplete engineering drawings, equipment that was promised by the suppliers but never manufactured and delivered, equipment that was regarded as necessary subsequent to the original budget being drafted, or even an extra door or aisle way. The PM should keep in mind that this column

is extremely important also for deletions that can be made to the project scope. This is the one column that permits the Project Manager to maneuver the project costs in order to more closely adhere to the original budget estimate.

A fourth and final column would be the summation of the second and third columns, and those numbers would then be compared to the numbers in your original budget estimate. The PM and the Cost Control Associate should attempt to adjust each of these values in an effort to have them more closely approximate the project budget. However, the PM will also have to deal with any additional items that have been added to the initial scope which have proven to be necessary. Consequently, before the PM is required to start cutting away at specific items in the budget, a comparison of the total cost at the bottom of the new fourth column should be made to the total projected cost of the original project budget.

Know Your Budget, Know Your Costs

By maintaining a close relationship with your Cost Control Associate, you will be in a stronger position to move rapidly and to ward off potential financial pitfalls. Conversely, smaller projects may not be able to support a Cost Control Associate. In this case you may have to wear two hats and keep your own set of financial records, or you may have access to a lower level employee who can at least enter the information that you give that person. That would be at least some benefit to the Project Manager, so that critical financial information can be regularly recorded, and the PM will be able to generate and issue regular reports.

As your project proceeds, rest assured that there may be significant differences in your forecast expenditures versus your actual incurred costs. Equipment and construction expenditures are seldom exactly as you had forecast, and there are usually several reasons for those variations. That is a principal reason why the Project Manager must keep up with “design changes” for engineering and equipment, cost of living increases, which are dependent on the overall length of your project, and the “contingency” factors that all PM’s must control.

You will be either pleasantly surprised or somewhat shocked as the actual costs begin to be recorded. For instance engineering and design costs may trend higher than what you had forecast. That may not surprise you if you have been following the design activities closely, and realize that there have been several

scope changes, including an attempt on your part and theirs to reduce overall equipment and construction costs. Remember that you are not autonomous in this venture; you have been working with this team and motivating them to be an integral part of this project, and to be participants in its ultimate success. You have come to believe, and often rightly so, that sound engineering practices will benefit the project in the final analysis. This information can be compared to your forecast budget for a given period of time, and can even be displayed graphically (again expenditures vertically and timeline horizontally).

8. Startup

Sometimes these two words, startup and closing, are used interchangeably by both the Client and the management members involved with the project. However, most experienced PM's are well aware that these two words are not synonymous. As the PM you have allotted sufficient time in your project schedule to test the equipment on site, even though you have undoubtedly had the manufacturer put the equipment through its necessary testing at the factory or shop. Now that the equipment is on site at your project, the manufacturer's representative as well as your own on-site personnel may be dealing with different conditions than what was available in an ideal shop environment. There is little doubt, however, that quality planning by the Project Manager and the project team to prepare for onsite testing and tryout of equipment will save both time and startup costs for the project.

Equipment can be damaged in shipment, particularly if it is coming from overseas. In addition special care must be taken by your construction manager to insure that the installation is in accordance with manufacturer's guidelines, that utilities such as electrical power and instrument air are clean, and that the manufacturer's representative is present for initial startup and testing. Your responsibility at this phase of the project is to acknowledge whether the equipment works as intended, and to communicate with executive management, your engineers, and the manufacturer whether it does or does not.

In the next phase of startup you and your team will be dealing with the coordination of individual equipment as it relates to other equipment on either side. This "systems integration" is the heart of your startup schedule, and may require the input and recommendations of many people on your project team as

well as operations personnel in the event that things don't go according to plan. In this event, even though you may be receiving (and recording) advice from all sides, you are still in control of the project and must continue to be the primary decision maker.

This phase of the project is where the relationships that have been developed by you (and your team) and operations personnel are so important. As part of the startup cycle many of these personnel should be present during testing of each piece of equipment, and the manufacturers' representatives who performed the original testing must be available to answer any operations' questions. The interests of the project team as well as operations are well served when this coexistence and continuity exists.

However, irrespective of the efforts that the Project Manager, the project team, and various groups associated with the project may have made, neither the PM nor Executive Management should expect perfection during this phase. Unless you are duplicating an existing facility, there is never any guarantee that a new facility will start up without any hitches or glitches. The great majority of new facilities, whether industrial or commercial, can expect to go through a "learning curve" which will require painstaking attention to detail in order to achieve a relatively successful operation. There is probably no hard and fast rule as to how long before your facility will achieve this success – some facilities achieve a high degree of success in six months or less, while others may be climbing the curve toward 100 percent operation for close to two years. The simple fact is that, if you have followed the principles and guidelines presented here, you are more likely to achieve complete success earlier rather than later.

9. Closing – Achieving Success and Avoiding Failure

There is almost always some pressure on the project manager to close the project in an early, if not orderly, manner. You will undoubtedly have a "punch list" of uncompleted tasks that, in your opinion, require resolution before the project can be officially closed. While you may not be inclined to close out the project under those circumstances, your assignment is to communicate with all involved parties. At this final phase of the project, and although you are dealing with a smaller group of personnel (Executive Management, Operations), their opinions matter a great deal to your future assignments and/or promotions. In spite of the phrase "Failure is not an option!" used in the Armed Services, pro

sports, and other environments, failure is still very much an option for the Project Manager. The PM must now utilize all the project management skills and tools that have been developed to make decisions and resolve open issues that will insure the success of the project. As you reach the final phase of the project, you are obligated to determine the following:

Are the Clients satisfied with the results of the project?

If the above question is answered affirmatively, then your function as project manager is essentially completed. You have fulfilled your obligations, and the pressure is mitigated to the extent that you have a happy Client. You are now able to improve the final details of the project rather than to significantly restructure it, and you are in a position to move forward with the closing documents that are required. There still are some final questions, albeit of lesser importance, which need to be answered prior to the conclusion of the project:

Are there any uncompleted tasks which may have a negative impact on the operations at a later time?

Nobody is asking you to look into a crystal ball, but you especially as well as your engineering team and your construction manager will likely be in the best position to make this call. They must assist you in verifying that all pertinent project drawings are updated and certified. Now that the facility is up and running, and possibly there is a production schedule to be met, your Client probably would not be willing to forego operations in order to achieve total completion. The last thing left for you to determine is:

Are project funds still available to complete the remaining tasks?

This is an easy one; if there are still some funds available from the original budget, which you have guarded so carefully to protect, then you should recommend that these tasks be completed by the outside services organizations and contractors that were used to perform the original project and may still be on site. This will enable your Client to capitalize the project to the fullest extent without any interference to the ongoing operations. However, if the decision has been made (by someone other than you) to have local operations and maintenance personnel perform any remaining tasks, then your goal has been

met and the time has come for you to sign off and move on to your next assignment.

Summary

As you may have discovered by navigating this course, having personal discipline and learning to delegate authority are very important characteristics of a Project Manager. The primary goal of this course in project management is to provide existing project managers and would-be project managers with the necessary tools to manage a successful project. In almost all projects the Project Manager and project team members will develop and utilize some core principles. One of those core principles is that the burden of assuring the finite factors of cost and schedule in addition to the end result is primarily the responsibility of the PM. Also the Project Manager is given guidelines and examples of what to do when a difficult situation presents itself. Invariably, the solution is not begun until the PM and/or the project team members recognize that a problem exists. It can then be resolved with training and experience, each of which is an equally valuable commodity.

Advanced Project Management

Questionnaire

Background/Education

1. A/an _____ background is a valuable project management tool.
 - a. Business
 - b. Finance
 - c. Engineering technology
 - d. All of the above

Experience/Training

2. Which of the following should a Project Manager know about the company?
 - a. The ultimate financial goal of the PM's project.
 - b. The ultimate financial goal of the company.
 - c. The company's current list of outstanding liabilities.
 - d. All of the above
3. A good character trait for a successful Project Manager is _____.
 - a. A reluctance to being criticized by Executive Management.
 - b. A willingness to criticize any member of the project team.
 - c. Preparing for future situations and opportunities that might occur.
 - d. All of the above.

Leadership Qualities

4. You as the Project Manager are expected to _____.
 - a. Micro-manage your project.
 - b. Tell your Client how well things are going, whether or not it's the truth.
 - c. Become argumentative with your project team when things aren't going well.
 - d. None of the above.

Motivational Skills

5. When Vince Lombardi had a football player who didn't achieve perfection, he _____.
- always got rid of that player.
 - put that player on the practice squad.
 - placed that player on injured reserve.
 - none of the above
6. A Project Manager can be likened to _____.
- A quarterback on a professional football team.
 - A head coach on a professional football team.
 - An offensive coordinator on a professional football team
 - A defensive coordinator on a professional football team

Scope of Work

7. Your first personal objective after you have received a project management assignment is to _____.
- Meet with the project team to find out what they know about the project.
 - Take a quick tour of the potential project site.
 - Meet with the Client and closest aides to determine precisely what they hope to accomplish with your project.
 - Look at the company's list of similar projects to determine how to go about managing your new project.
8. When building your project team, you need personnel that have the same _____.
- Personality
 - Technical background
 - Characteristics and objectives
 - Employment experience.
9. Issuing a weekly progress report to management from the Project Manager _____.
- Keeps management current with the progress of the project.
 - Apprises management of any short or long term problems.
 - Affords management the opportunity to be involved in the project.
 - All of the above.

Developing a Budget

10. A measure sometimes taken by the Project Manager when the Budget is too high is to: a. Proceed with the project and hope for savings to occur later in the project.
b. Work with the project team and the Client to reduce the Scope of Work in a logical manner.
c. Reduce the Scope of Work without regard to management's ultimate objectives.
d. None of the above.
11. When preparing a preliminary budget that has many unknown cost factors, the Project Manager should _____.
 - a. Consider a contingency factor possibly as high as 5 to 6 percent.
 - b. Consider a contingency factor possibly as high as 12 to 15 percent.
 - c. Lowball the estimate to get funding for the project and deal with the consequences later when the scope is better defined
 - d. None of the above

Scheduling

12. An experienced Project Manager will
 - a. Relate the project schedule closely to the project budget.
 - b. Keep the project schedule completely independent from the project budget.
 - c. Show minimum concern for the project schedule.
 - d. Show minimum concern for the project budget.
13. When developing an initial MS Project schedule, most of your float time should be _____.
 - a. Right at the beginning.
 - b. In the middle.
 - c. Toward the end.
 - d. Do not use float time as a scheduling tool.

Engineering and Design

14. The responsibility for sizing the equipment and determining the specific requirements of that equipment lies with _____.
 - a. The Project Manager.
 - b. The engineering and design team.
 - c. The procurement department.
 - d. The Client

15. The engineering group _____.
- a. Is directly responsible to project management.
 - b. Needs approval of the Project Manager when scheduling a visit to a supplier.
 - c. Notifies the Project Manager if a supplier will be late with deliveries.
 - d. All of the above.

Procurement

16. A major factor in project cost overruns occurs when _____.
- a. A constructor is in standby, waiting for equipment to be delivered.
 - b. Procurement places a contract with a sole source supplier.
 - c. The Project Manager requires a thorough review of all proposals by engineering.
 - d. The Client rejects one of the bidders as a supplier of equipment.
17. When selecting a supplier for any major or critical equipment, the Project Manager and the Procurement Department should _____.
- a. Evaluate that supplier's history with the company.
 - b. Not accept a promise from a supplier that has never met your particular criteria.
 - c. Visit that supplier's facility to determine their work load and quality control program.
 - d. All of the above.
18. The _____ can assist the Project Manager by expediting the supplier and maintaining the original intent of the project schedule.
- a. Legal group
 - b. Procurement group
 - c. Client
 - d. All of the above

Construction

19. In general, the prudent use of overtime _____.
- a. Can benefit the project for a myriad of reasons
 - b. Is never a good idea
 - c. Is only a benefit to the contractor
 - d. Both (b) and (c)
20. One advantage in dealing with one general contractor rather than numerous smaller contractors is that;
- a. There are fewer employees to have to pay.
 - b. There is usually only one construction representative with primary responsibility.

- c. The Project Manager doesn't have to be concerned about safety rules and regulations.
 - d. None of the above.
21. Courts have ruled that a company or organization cannot implement a penalty clause in a contract _____.
- a. When the total value of the contract is under \$10 million
 - b. Unless it is a design/build contract where the contractor is not dependent on other parties
 - c. Unless a corresponding bonus clause is also stipulated
 - d. Under any circumstances

Cost Control

22. The Project Manager must keep up with _____ in order to control project costs.
- a. "Design changes" for engineering and equipment.
 - b. Cost of living increases, which are dependent on the overall length of your project.
 - c. The "contingency" factors that all PM's must control.
 - d. All of the above.

Startup

23. There is a need to test and try out all major equipment _____.
- a. At the supplier's factory or test site.
 - b. As soon as possible after all the major equipment has been installed.
 - c. As soon as possible after all the major and auxiliary equipment has been installed.
 - d. All of the above.

Closing

24. Before the project can be officially closed, verification must be made that all pertinent project drawings are updated and certified by _____.
- a. The Project Manager and the Client.
 - b. The Project Manager and the engineering team.
 - c. The Legal Department.
 - d. The Procurement Department.

25. The completion of any remaining punch list items is the joint responsibility of

_____.

- a. The Project Manager and the Client Representative
- b. Company management
- c. The contractors
- d. The Procurement Department

Online Course (4 PDH)

Advanced Project Management Techniques - II

Dominic P. Perrotta, P.E.

2015

Advanced Project Management Techniques

Dominic P. Perrotta, P.E.

Introduction

This course in project management is a continuing attempt to improve the prospects for existing project managers and would-be project managers to manage a successful project. This course provides the student with a series of case studies of actual Project Managers and projects for which they were responsible. Advanced Project Management - I is not a prerequisite for this course which is meant to be a sequel to APM-I, and is intended to broaden your knowledge about how successful projects are managed. Once you have completed this course, you will realize that there are no perfect projects, nor are you expected to be a perfect Project Manager.

This course is divided for all Project Managers into three important categories, which were previously defined in APM-I:

1. Leadership
2. Decision Making
3. Project Team

In each category there are two different case studies, and in each case study the Project Managers utilized certain techniques, mostly orthodox but some unorthodox, in order to bring the projects to successful conclusions. Regardless of the paths that were chosen by the Project Managers, their implementation of the core principles of quality project management proved to be a huge asset. You will also recognize that, although these Project Managers may have had different levels of experience, they all went about their business in a confident and professional manner.

The last part of each of these above three categories tries to give an interesting account of people that we either know or have read about who faced similar challenges in the sports world. The projects that each of them managed was simply their livelihoods. Through diligence, wisdom, and an understanding of those around them, they were able to be successful in their life's projects.

The fourth and last section of this course relates what actually took place following a major fire at a large manufacturing plant. In this case study, the Project Manager went beyond anything that he was obligated to do, resulting in a great savings to the plant as well as significant future benefits to his engineering firm and to himself.

Course Outline

- I. **Dealing with Engineering Firms**
 - A. **Small and Local Firms**
 - B. **Intermediate and Multi-National Firms**
 - C. **Defining Leadership**
- II. **Dealing with Manufacturing Company Management**
 - A. **Mid-sized Companies**

- B. **Larger and Multi-National Companies**
- C. **Defining Decision Making**
- III. **Dealing with the Project Team**
 - A. **Matrix Organization**
 - B. **Direct Supervision Team**
 - C. **Defining a Project Team**
- IV. **Negotiating with Insurance Companies**

[Advanced Project Management - II](#)

- I. **Dealing with Engineering Firms**
 - A. **Small and Local Firms**

Occasionally a Project Manager may receive a telephone call with a surprising and completely unexpected message. A PM received such a phone call late one summer afternoon after successfully completing a rather large project in a nearby city. The caller was the president of a mid-sized engineering firm that was in the expansion mode, and had just

received a verbal commitment from the vice president of a large North American industrial company to provide engineering services for the company's new Greenfield project. However, there was one stipulation prior to the company issuing a formal contract to the firm; they must be willing to hire the Project Manager of the company's choosing, who happened to be this particular PM. This individual, who had previous experience with the company as a PM, would also be able to furnish substantial production expertise – a quality that was lacking within the engineering firm's organization.

A meeting time was established within a few days of the phone call at the engineering firm's offices, at which time the PM met both the president and vice president of the engineering firm – no representative from the industrial company was present. The PM listed previous involvement in various projects, particularly those related to the industrial company. The management of the engineering firm furnished a basic list of activities that they had performed since their starting the firm about ten years earlier. The meeting was going smoothly and issues of the firm's work hours, office space, lines of communication, payroll dates and reporting procedures were discussed and quickly resolved. When the subject of payment to the PM finally came up, however, the meeting became slightly contentious.

Be Humble but Be Prepared

The PM was an independent contractor who was close to Social Security age and had been paying his own social security taxes and income taxes, had his own healthcare plan, and lived less than 15 miles from the engineering office. Although he exhibited his enthusiasm for the new project and the firm's role, he was in a strong position to negotiate a good rate from the engineering firm, since failing to hire this PM would jeopardize the firm's pending contract. The initial offer from the firm was quite low, in keeping with the engineering firm's policy. At this point wage negotiations began in earnest, and both the firm and the PM utilized their best arguments for winning the verbal, albeit peaceful, battle that ensued.

The PM's counter-offer was substantially higher than the firm's original offer and represented a figure that was more or less in line with the type of wage (or salary) that was customary for the project involved. His offer was immediately met with great resistance. After a few higher and lower numbers were brought forth, the PM then asked the firm's management to provide a copy of their proposal to the industrial company. The engineering firm apparently agreed to supply the requested information, although with some degree of reluctance and hesitation, and their proposal included the following information:

1. A summary of the total hours for the firm's Project Manager to complete the project;
2. All hourly rates that would be charged to the industrial company during the course of the project, including those for the Project Manager;

3. A summary (resumes) of the experience of the engineers, designers, and drafters who would be involved with the project;
4. Letters, memos, and emails linking the engineering firm to the financial success of the project;
5. Previous projects by the engineering firm either of a similar nature or with the industrial company, accompanied by any letters of commendation or criticism.

Take the Initiative

The PM took a day to analyze and evaluate the data from the firm's proposal, calculated the cost of personal taxes, healthcare, and other potential expenses and arrived at a number that was presented to the firm as a compromise. The PM's rate was sufficient to cover expenses, and to earn the PM a good income for the work performed. It also allowed the firm the opportunity to receive a net profit of more than thirty percent of the hourly rate that they would charge to the company, and this last remaining issue was accepted and adopted by both parties.

However, the PM quickly became aware of the reason behind the engineering firm's reluctance to share this proposal information. Buried in the proposal was a substantial number of hours plus accompanying rates for "administrative fees", meaning that the two owners of the firm would be "double-dipping" - collecting on the markups of the engineering team that was actually working on the project as well as direct billing the industrial company for work in which they were not directly involved. The compromise to this situation was to reallocate most of the owners' hours to the engineering group, including to the Project Manager, while the owners would bill the industrial company only for those hours that actually involved their work on the project.

Possess a Teachable Spirit

For a little over one year (actually 14 months) the Project Manager's assignment with this coastal engineering firm was to function as their PM on this local project that they had won with the low bid. The PM provided leadership and production expertise to the firm's in-house design team, being mindful of the fact that, due to its low-bid nature, the project would be under constant scrutiny by the firm's management.

During the course of the project the PM was diligent and respectful of the engineering firm's quest to do a good job and to make a decent profit, while at the same time leading the engineering group to provide a quality facility for the industrial company. As the individual

with the most related experience on the project, the PM also felt duty-bound to protect the industrial company Owners' interests and ensure that the new facility would function properly and would ultimately provide the company with a decent profit margin for their new products. Because of the high profile nature of the project within the company, and owing to the company's request that the PM furnish them with his production experiences for making their project a success, this created other issues not of the PM's making.

Despite his being required to routinely explain the purpose and function of the industrial company's operations to his project team, his efforts were not always met with wholehearted support and enthusiasm by the engineering firm's top management. While his production expertise was always met by the project team with appreciation, the Executive Management of the engineering firm would occasionally try to derail his efforts. Whether this action was due to his favored status with the industrial company or just the management firm's seeming lack of control over every output was never quite clear to the PM.

At one stage the firm's vice president countermanded one of the PM's recommendations for proper grounding design while the PM had been gone for a few days to visit a supplier. Upon his return and having been made aware of the VP's action, the PM had challenged this design change, explaining to the VP why his design would be neither functional nor acceptable to the Plant Owners. Furthermore, the Project Manager suggested that they investigate the reasoning for the PM's recommendation with the Plant Owners. When the Plant Owners supported the PM's recommendation, explaining that traditional electrical grounding was ineffective due to the very high water table in the plant, the matter was seemingly settled and the project proceeded.

However, there were other incidents that involved the engineering firm's VP and the PM. On another occasion while in an automobile with him and the firm's president (the other owner), the VP threatened to fire the PM on the spot for not billing the industrial company sufficiently during the previous month. The PM attempted to justify the lower billing month by explaining that two of the engineers on his project team had been on vacation that month, that no one had been available to replace them, and that billing should be quite strong in the coming month. The firm's president diffused the situation by explaining that the PM had come to him for additional support before the vacations occurred, but that nobody was available due to their small size and the critical nature of another project, thus again offering necessary support to the PM.

As the project was winding down, the engineering firm had decided to bid on another large, industrial project being planned in an adjoining state by an international company. Their confidence had been buoyed by the pending success of the existing industrial project. About

two weeks before the very successful startup of the current project, the engineering firm was informed that they had been selected because they were not only the low bidder on this new project, but also in large part because of the firm's success with the project which was being concluded. The engineering firm, seemingly feeling that their capabilities were now sufficient to manage an industrial project of such size and scope, made no attempt to negotiate with the PM for the new project.

Be Flexible and Sincere

In the meantime the PM had been directly contacted by the Owners from the industrial company to determine if he would be their contract Project Manager for a new industrial facility similar to the one being started up, which was two states away. The PM's decision was based partially on money (there would be no markup by any engineering firm in order to make a decent profit) as well as the integrity of the industrial company Owners. When he notified the engineering firm of his decision to work directly for the Plant Owners, but to support them for the next few months with their new industrial project until a replacement could be found, he was shown the front door quickly and without any kind of thank you for his efforts.

Following his rather ungrateful departure from the engineering firm, the PM spent two years on the new project, engaged with a larger and more experienced engineering firm, and completed another very successful project. His former engineering firm began its new project with a minimum of industrial expertise, struggled through the early phases of the large industrial project, and were finally relieved of their contract obligations after about six months. There are many lessons to be learned by the Project Manager as well as by the engineering firm and the industrial companies regarding these activities.

Summary: Whether functioning as a direct employee or as an independent contractor, a qualified Project Manager should always try to be in a position of strength in order to negotiate the best contract, whether with an engineering firm or with the company. Often a PM may be hired or retained primarily for his or her specific expertise in a commercial or industrial endeavor. Under the circumstances in which this PM was hired, and in spite of his enthusiasm and sincerity, he was always considered a liability in the eyes of the firm's management.

While taking the initiative and exhibiting a large degree of flexibility may be key factors in ultimately achieving success, the support of the firm's management is very critical. Obviously the firm's vice president had much more personal ambition than concern for his employees and the project, and seemingly harbored a great deal of resentment toward

the PM throughout the project. However, the PM never seemed to become discouraged, and maintained an open line of communication and cooperation with all parties involved.

B. Intermediate and Multi-National Firms

Bruce had been a Project Manager for a large industrial company with operations throughout the United States, but had an enterprising spirit. Bruce felt that he could do better with his own company, and decided to form an engineering and construction company that would service local customers with efficiency and quality. Starting out with just one other employee, Bruce worked 12 to 16 hours a day, and often six days a week. Bruce had a business background (degree also) and a good understanding of what was required to build his firm: work hard (to the point of sacrificing a normal lifestyle, find a niche market, and offer sincere and loyal service. Within five years Bruce was a successful entrepreneur with a monthly payroll of several hundred thousand dollars. Articles were written about Bruce and his successful company, and Bruce seemed to have discovered the methods for satisfying his customers. Then some of Bruce's mistakes and some outside events occurred which entirely changed the course of Bruce's company as well as his career.

In the process of expanding his company, Bruce had hired some employees who did not have the same set of ethics and loyalty that were needed to maintain quality relationships with the customers. In addition Bruce had taken on larger and larger projects, which had resulted in increased financial burden and greater debt. Then, without any warning, one of his company's largest customers declared bankruptcy, setting up a long and costly court battle. Soon following that devastating news, one of his company's key personnel became grievously ill, leaving Bruce without the necessary support in critical areas of his business. Finally, in an effort to increase the magnitude of the company, one of his largest projects was grossly underbid and lost several hundred thousand dollars. This financial blow caused Bruce to drastically reduce his employee workforce and raised the possibility that he would face personal bankruptcy. To his credit, Bruce worked tirelessly over the next few years to pay off his creditors and never did consider declaring bankruptcy. At the end of that time in his life, Bruce closed his business and looked around for a company that might want to hire him.

No Time for Discouragement or Self-Pity

One of his former employees suggested that Bruce talk to a large multi-national engineering and construction company with offices in most of the United States as well as more than a dozen foreign countries. Bruce called the HR Manager, who informed him that they did not

have any immediate openings; however, one of their Southwest offices was expanding, and he would make arrangements for an interview. Bruce was not too enthused about making the trip, not even when the HR Manager called him back the next day and told him that the company would reimburse Bruce for the airfare, and that they would have a driver from the office there to meet with Bruce the following Monday outside the airport terminal. Although those issues had been resolved between the company and Bruce, he still did not feel comfortable about the interview, nor did he have the faith in his abilities after his recent business failure. Believing that the whole day just might be a waste of time, nevertheless, Bruce made his plane reservations and called the HR Manager's secretary to notify her of his travel plans.

Surprising Development

On Monday morning Bruce dutifully boarded an early morning flight to his destination, still feeling less than confident about the purpose of the trip. Once the plane landed and Bruce made his way into the terminal, he headed immediately for the terminal exit. Outside the terminal he spotted the company's car, and quickly walked over to it. Expecting to be greeted by a single driver, Bruce was totally shocked to see three men in business suits sitting in the large sedan. Each man greeted Bruce warmly and identified himself by name and position in the company. One was the Office Manager, or vice president, and the other two were the General Managers. Bruce was nearly overwhelmed by the surprise reception, but did his very best to keep his cool. That morning he was introduced to several employees, and was shown all of the company's latest tools, devices, and instruments that made them unique and gave them a worldwide advantage. Over lunch the Office Manager presented Bruce with an offer for employment and asked him to seriously consider it, because they would like him to start with them the following Monday. Bruce said that he would talk it over with his wife, bid them farewell, and boarded an early afternoon flight.

The very first thing that Bruce did, after he got back home and told his wife about his visit, was to call his former employee who had recommended the company originally. There were some surprising issues that had occurred since Bruce had called the company and requested an interview the previous week. On the Friday before Bruce arrived for his interview, the company had terminated a Project Manager for mishandling a major project that was being closely watched by most of the top executives in the company. Furthermore, management for the client had criticized the now dismissed PM for being uninformed about their industry and overall objectives as well as unresponsive to their requests for expedient service. The engineering firm's executives spent the rest of that Friday and much of the weekend trying to determine their course of action. Then they analyzed Bruce's resume, realized that he had a strong background in both project management and that specific

industry, and had an offer prepared before they actually met with him. The only thing that could have prevented the company from presenting the offer to Bruce was either arrogance or indifference on his part; instead they found him to be likeable with a confident air of humility, so they made Bruce the offer. He accepted their offer the next day and began his new assignment the following week.

Assignment to An Ongoing Project

On the first morning of his new job, Bruce signed all of the necessary “new employment” documents and was introduced to many of the firm’s employees, including the other top management members that he had not met the previous week as well as most of the members of his new project team. That afternoon he met with the office’s financial manager in order to develop a clear understanding of the financial and short term status of his new project. What he learned from her was not very comforting; the project had only a few thousand dollars available to charge to the company, and the company had refused to authorize further funds – they were seriously considering cancellation of the contract with the firm and finding an alternative source. Later that afternoon Bruce met with several key individuals on the project team. Each engineer and designer gave a nearly similar answer when Bruce asked them what kind of problems they had encountered on the project; the previous Project Manager was “...in over his head”, “...had little understanding of the industry”, “...was prone to berate team members” in front of other team members and even top management, and never took any blame for any of his miscommunications or inadequacies.

New PM Makes It His Project

Bruce had learned several lessons from his experiences over the previous ten years as an entrepreneur, and the ten years before that as a highly regarded Project Manager. Whether functioning as a PM, or following his excursion into the area of starting and operating an engineering and construction company, he realized that being sincere with his clients and acknowledging when his firm occasionally did not have the necessary industrial or commercial experience were crucial to the success of his firm. Bruce brought that attitude with his new assignment as a Project Manager and, while that sometimes had caused political heartburn among his superiors, the customers had usually been patient with Bruce and his project team and had remained positively responsive. The following morning Bruce called the company’s vice president, who was the company representative responsible for the success of the project, and introduced himself as the new Project Manager. Bruce arranged a meeting and flew to the company’s mid-west office the next day to meet with the VP and other company executives. During the meeting some of the management members recognized Bruce from past projects, were comfortable with the new direction of

the engineering firm, and agreed to authorize an extension to the firm's contract for several hundred thousand dollars.

During the ensuing months, as the eyes of the firm's top management were on Bruce and the project team, his performance became less scrutinized and the project activities became somewhat routine. Bruce had learned the critical lessons of a quality Project Manager: never take anything or anyone for granted; trust but always verify, and listen to ways in which he and the project team could improve. Bruce also became aware of the nuances of a large, multi-national engineering firm: practices, procedures, and politics. Very rarely in the first year did Bruce get involved in water cooler or coffee pot discussions. He preferred simple meetings, always pre-scheduled and usually one-on-one, with his team leaders, department heads, and other staff members such as the Financial Manager (a female) and the Director of Marketing (also a woman). The firm's portion of the project was completed successfully over the next several months. Bruce's management skills and client relationships were duly noted by the firm, and he was offered a promotion by the firm, which he accepted after completion of the project. However, the politics of such a large firm became overwhelming to Bruce and his senses of discipline and humility. He remained loyal to the firm throughout his short career with them, but was open to other opportunities that were presented to him.

Summary: One thing that usually escapes a quality Project Manager with a good track record is that he or she will often be exposed to new and greater opportunities. A Project Manager should always have the faith that he or she will succeed where others may have failed. There is a common concept that a good executive can be just as good at another company, no matter where that executive has been or where he or she is going. Unfortunately, that philosophy is sometimes proven wrong; a CEO from a sporting goods company probably won't have an easy time trying to manage an oil company, or even a multi-national bank.

However, this same philosophy usually does apply to Project Managers, who might have a golf course as a project this year, a refinery next year, and a 20-story bank building the year after that. In addition to being a decision maker, a successful PM is a planner and a builder. Although a quality Project Manager always has a high value and should be open to opportunities, the very best thing that any PM should do is stay completely loyal to the present company, while being open to opportunities that may arise.

c. Defining Leadership

In a previous course, which is referenced as Advanced Project Management - I, there were numerous leadership characteristics that were used to define a quality Project Manager. While that course is not a prerequisite for this one, its emphasis on the personal values required by a successful PM will hold very true as you read through and study this course.

One of those leadership qualities that was not discussed in the previous course centered around a relationship between Head Coach Vince Lombardi of the Green Bay Packers and Bart Starr, his quarterback. Mr. Starr had been drafted in the 17th round in 1956 by Green Bay – at that time there were only 12 teams in the National Football League – and was used primarily as a backup quarterback and in mop-up roles as the Packers struggled to a franchise low 1-11 record in 1958. In danger of losing their franchise, the Packers hired Mr. Lombardi in 1959 to help change the direction of the team and to salvage the franchise. Needless to say, no one could have predicted how much Green Bay's good fortunes would occur. In the period of time from 1961 through 1967 the Packers won five league championships, including three straight and the first two Super Bowls. While that was considered one of the greatest turnarounds in professional sports history, nevertheless the late Paul Harvey would have said "...and now the rest of the story."

Mr. Lombardi had a reputation as a perfectionist with a very volatile temper and a very short fuse. Midway through the 1959 season he had installed Mr. Starr as his starting quarterback, primarily due to what he considered Mr. Starr's leadership qualities, and the team completed the season somewhat successfully with a 7-5 record. During a pre-season practice the following year Mr. Lombardi was very vocal, being critical of nearly all of his players, including issuing a stern reprimand of Mr. Starr in front of the rest of the team. After practice Mr. Starr caught up with Mr. Lombardi in his office. He politely but firmly reminded Mr. Lombardi that he had asked Mr. Starr to be the leader of the team – in those days there were no headphones in helmets and quarterbacks called nearly all the plays. Mr. Starr then informed Mr. Lombardi that, in the future when he had a criticism of Mr. Starr, he should call Mr. Starr into his office and air his grievances in private. From that day forward Mr. Starr and Mr. Lombardi had a player-coach relationship that resulted in five league championships in a six-year period. Mr. Starr not only became the leader of a great team, but was also awarded the Most Valuable Player of Super Bowls I and II.

As a Project Manager, one of your strongest qualities will be in the leadership role. Although you are expected to be a decision maker, not every decision that you make will be met with approval by executive management, and you may sometimes be criticized or even reprimanded. The same situation will hold true for those on your project team who are actually responsible for the numerous tasks that propel a project. You as a Project Manager would like to command the same respect that Mr. Starr received from Mr. Lombardi by

having any dissatisfaction of your performance expressed to you only behind closed doors. This same philosophy should apply to those members of your project team whenever you are dissatisfied with their efforts or production on your project.

Summary: Leadership is both a way of life as well as a state of mind. Nobody is born with it, just like nobody is born with true discipline or humility. However, many people naturally develop the necessary skills for true leadership early in life through good parenting, personal experiences, and other tangible methods. Others may acquire it later in life through diligence and effort, including study and training. Irrespective of how you have managed to position yourself as a leader, know that leadership is one of the two or three greatest qualities of a Project Manager. As you go through this course in Advanced Project Management, you will note several other important qualities for a PM, although none is more important to the success of your project than strong leadership

II. **Dealing with Manufacturing Company Management**

A. **Mid-sized Companies**

Following his moderately successful completion of a difficult multi-million dollar project, Sammy was asked by a similar-sized company to manage their new project. Over the next two months Sammy as the Project Manager was given the opportunity to meet with the team of executive managers who had the responsibility for scoping and developing the budget for the new project. The first meeting, which included Sammy and three company executives, occurred at the company's North American home office on a truly cold winter day. Once the meeting began and Sammy was introduced as the Project Manager, he was made aware of the scope details of the project. Their plan was to design and build a Greenfield plant in the southeastern United States that would receive unfinished products from a nearby plant, complete the manufacturing of those products, and non-destructively test those products. The finished and quality inspected products would then be shipped to all parts of North America. All of this was in his area of experience and expertise, and Sammy soon became comfortable with the project and the people describing it until the management executives on the team began to define the process that would be used for the production portion of the project..

A Subtle Warning

As the management team began to describe the method that they planned to utilize for the finishing process, Sammy quickly realized that this part of the project did not represent the industry standard and was not anything with which he was familiar. The standard industry process for finishing these products, whether they were long or short, square or round, was on an individual unit basis to maintain consistency and quality control. The company plan for preparing the products to be finished was a continuous process that utilized an older technique which was inconsistent, did not follow industry quality control practices, and during the past forty years had been abandoned by similar companies as being not only obsolete but also too costly and quite fallible. The industry standard for the past several decades had been to bring the product up to a certain process temperature, usually between 1650°F and 1750°F, in a natural gas-fired furnace. Each product would then be individually discharged through a furnace exit door and into an enclosed quench unit, where the heated product would be quickly drenched with a high pressure water spray.

Quickly estimating that this portion of the project would represent about 25% of the total project budget, Sammy was at first disbelieving, and then really dismayed. The scope was so contrary to any similar project in which the PM had been involved that he remained completely silent, choosing only to ask specific questions during the remaining discussions. Sammy was aware that a similar project had just been concluded at one of that company's other plants within the past six months. That facility was utilizing the latest technology, and was already operating very successfully. Listening carefully regarding this area of the project scope where the PM had many years of expertise and experience gave Sammy an uneasy feeling, but the management team was surely knowledgeable of the recently completed project at one of their other plants. Although he was feeling a certain amount of discomfort with this most critical scope of the project, Sammy believed that the management team very likely had good reasons for their decision..

Sammy's Concerns Were Temporarily Tempered

Toward the end of the four hour meeting, the rationale for the company's scope for this new project became apparent. The company had a similar facility at one of their older North American plants which functioned seemingly quite well. Neither their Board nor their Executive Management had any interest in changing to a newer or different technology in their attempt to expand their product business model as well as the company's actual production.

The leader of the team – we'll call him Dave - was extremely pleasant and knowledgeable, and was the company's General Manager – Operations for all North American plants. The new Project Manager and he hit it off very well, and they met twice over the next thirty days to finalize the budget. One of the meetings occurred at the company's home office,

while the second meeting was at a company's planned plant expansion site in the Southeastern U.S. After that second meeting, Sammy never saw Dave again. Just three days after his visit with the new PM, Dave died of a massive heart attack while playing in a pickup basketball game in his hometown. To say the least, the entire company as well as the new PM were devastated, not only by the sudden death of a middle-aged man who was a good friend to all that knew him, but also because of the uncertainty of the new project.

The Company Regroups

About two weeks after the initial shock waves surrounding Dave's death had subsided throughout his company, Sammy received a phone call from the company's vice president who had been involved with the company's most recent project the previous year. Stuart informed the new PM that the company wished to proceed with the project, that they still wanted Sammy to be the Project Manager, and that Stuart would be the new Company Representative for future activities. The PM was asked to finalize a project schedule and a project budget by the end of the week which the VP could present to the Board of Directors at their next meeting.

Sammy worked on those two items practically from sunup until sundown for the next four days, talking to engineering firms, suppliers, and contractors who might be involved in the project. By the end of the week he had a project schedule that, with the exception of one major equipment supplier who later proved to be unreliable and several weeks late on deliveries, would prove to be very accurate. However, he was very apprehensive regarding the project budget. The PM adhered to the planned scope of the new facility as defined by the executive management team, but many outside changes had occurred. Some of the suppliers that had supplied the original equipment for the older facility were no longer in business, while others had raised their prices much higher to cover inflation as well as previous losses on marginal equipment. The final budget package which Sammy presented, including a somewhat abnormally high contingency, came in at slightly more than ten percent over the initial budget. Although this made it the highest capital project in the company at that time, the new Project Manager analyzed the numbers several times, but could never significantly affect a reduction in the bottom line.

The Project Moves Forward

Subsequently, Sammy submitted the project schedule and the project budget to the Company Representative with some trepidation. To the Company Representative's credit he reviewed the package, accepted it with very few questions or changes, and submitted it at the next Board meeting. The project was approved in its entirety at the Board meeting and the new Project Manager was handed a project with which he did not have complete

familiarity, would receive minimum guidance from others, and lacked total confidence that the project would achieve a high degree of success.

As the product preparation process was the most critical part of the project and represented a high percentage of the project's costs, one of the first actions by the Project Manager and the Company Representative was to seek out suppliers who claimed to qualify for their needs, including the one supplier who had provided the similar system at the company's other North American plant many years prior. Three seemingly credible suppliers were selected and individual meetings were scheduled with each. After those meetings that each lasted all day with the three potential suppliers, the Company Representative and the Project Manager reached the same conclusions; all three suppliers could probably satisfy the first phase of the preparation process, only the one supplier who had worked with the company prior could possibly satisfy the requirements of the second phase, and none of the three had the internal ability to satisfy the requirements of the third phase.

The PM and the representative then made the decision to work with the one supplier, which shall be designated hereafter as Acme, that had provided the prior product preparation system to the company. In order to provide the engineering for the balance of the project and to furnish oversight for the Acme portion of the project, Sammy and Stuart selected a local engineering firm to provide them with a qualified project team. The PM and CR then offered Acme the opportunity to enlist outside support of the company's choosing. The PM, project team, and Acme met with a third party company that had over fifty years experience in how to efficiently process the products in order to improve the metallurgical and physical properties of that product.

Another Warning Sign

However, Acme refused to accept any help or support for two reasons: 1) they claimed to know as much about properly processing those products as the third party company, and 2) anything that they might learn from the third party company would not be held proprietary and might be used by Acme in future projects. Consequently no real agreement was reached with Acme other than the basic fact that the company was removing the third phase of the project from their contract and would be purchasing that item separately. The company, cautiously supported by the Project Manager, felt that Acme would be the most logical supplier for the first and second phases of the preparation process. The PM was hoping that Acme could actually deliver the system design and the equipment that would satisfy their needs, based on their promises, their facility at the other company plant, as well as any support that the PM and the project team could provide.

A contract was drawn up by the company's legal department, accompanied by the Project Manager's very rigid specifications. The legal department developed a set of terms and conditions that appeared to be quite stringent as well as compensatory, and which later proved to be very prophetic. After much review and discussion, the contract was signed with Acme, the preferred, although somewhat suspect, system supplier for several million dollar. The PM and the project team knew that a big part of their workload would be the expectation for them to keep close watch on Acme's activities.

Acme was encouraged to submit preliminary drawings as soon as possible (within three months of contract signing), particularly for the design of the second phase equipment, so that Sammy and the project team could determine their specific capabilities in that area. In a little over eight to ten weeks after the official purchase order date, drawings started to trickle into the engineering group. Unfortunately, the drawings that they were receiving from Acme were mostly generic, illustrating systems that had been designed for previous customers over a thirty year period. As expected, the Acme had a good knowledge of how to uniformly and consistently prepare the products to the specifications of the initial phase, and was able to provide a bill of materials which allowed the project team to design the necessary main building as well as the large control room that would be needed.

During the next six months, the supplier submitted certified drawings of the system that was designed to meet the specifications of the first phase. Although this was a very complicated system from an electrical and electronic standpoint, the Acme design seemed to be very logical and quite appropriate for a company that had been providing this type of system for nearly forty years. At no time did the Project Manager or any member of the project team have any qualms or express any serious doubts regarding Acme's abilities to successfully furnish this portion of the project.

Obvious Shortcomings

However, once the certified drawings for the second phase of the system started to arrive and be reviewed, the project team quickly realized that the supplier had huge deficiencies in its design, and Sammy immediately notified the Company Representative of his concerns. As described earlier, there was a certain amount of expertise that was necessary in order to achieve success for this phase of the product preparation. For instance, the pumps that Acme was proposing were inadequate in volume and of a lower pressure than was needed for a successful performance of the second phase. In addition the water nozzles on the manifold rings that Acme planned to utilize surrounding the hot product were essentially misdirected to the product; the PM and several of the project team knew from years of experience that the nozzles had to be at a reasonably precise angle in order to function

properly and provide the optimum product. The analogy which was used was that of chopping down a large tree with an axe; if using a chopping blow perpendicular to the trunk, the tree may not fall anytime soon, whereas the use of an angular chop would much more quickly cause the tree to fall. Once this penetration occurred, the hot product almost immediately developed a much harder and tougher metallurgical structure; otherwise the only thing that the water was accomplishing was to cool the product to a near ambient temperature, thus having no effect on the product's metallurgical properties.

The CR was very clear in his instructions, again informing the PM that his job was not to design the system for the supplier, that Acme had refused the help that had been offered, and that they would have to suffer the consequences if they should fail to perform per the contract. The Project Manager felt that this was the incorrect approach by the company to a potentially serious problem, and that both the company and supplier could stand to lose financially. Although he voiced his objections about this company philosophy and expressed some serious reservations, the PM and the project team continued on with the project.

Investigation Launched

Over the period of the first six months of the project the Project Manager had become very well acquainted with the person who had been designated by the company to become the Manager of Operations for the new facility. During the next few weeks, and owing to his concerns as well as those of the PM regarding Acme's abilities, they made arrangements to visit the one North American plant which had Acme's product preparation equipment installed. Accompanying them on their visit were representatives from Executive Management and also two Quality Control personnel. After two days of close observations and review of the quality control records, the group came to the realization that the product yields were considerably lower than what had been reported. The implication was that the plant was losing a significant amount in terms of revenue and profit.

The company was immediately notified of this fact and launched an investigation into the plant's past and current activities. The PM felt personally exonerated that his concerns and those of his associates regarding this supplier had been justified. Nevertheless, Acme continued to insist that it was providing the design and equipment for the new facility necessary to meet company specifications and production requirements. The company, much to Sammy's consternation, maintained its "...let them fail, we'll sue them later" attitude and refused to allow the Project Manager or any member of his project team to offer the supplier any considerations for how to improve their systems. Conversely, the Acme was insistent on its expertise and ability to perform, and continued to maintain its attitude that it was fully capable of fulfilling its contract. Regardless of what issues the

Project Manager and his associate in Operations attempted to resolve, they were continually met with resistance.

However, when the so-called phase 2 drawings began to be received and reviewed, the project team quickly realized that the supplier had huge deficiencies in its design. Sammy immediately notified the Company Representative of his concerns, which included inadequate delivery systems and an exit system that would be very costly to operate and maintain. The CR again informed the PM that his job was not to design the system for the supplier, that Acme realized the importance of providing a system that would meet company specifications, and that the terms and conditions of the contract with Acme were clearly defined. The only thing left for the PM to do was to alert the company to any potentially serious problems, and expressing his opinion that both the company and supplier could stand to lose financially. Although he voiced his objections to this company philosophy and expressed some serious reservations, the PM and project team were directed to continue on with the project.

During the next few months Acme issued certified drawings to the engineering group pertaining to the scope of the equipment which they would be supplying for the quench system. Acme offered no parameters for transferring water from their pumps to their open quench system, nor for any flow controls, pressure regulators, or safety shutoff valves. Furthermore, their open quench system would allow water to be sprayed all over the operating floor as well as torrents of water to infiltrate their high voltage electrical room. Without any company knowledge the PM authorized the engineering group to design a proper piping system from the pumps to the quench headers.

Warnings Were Not Heeded

The project continued on for the next several months, and except for some late deliveries by one of the other major suppliers, went through a certification and startup phase without a great degree of difficulty. Acme also completed delivery of the preparation equipment, and that section of the new facility began operation as scheduled. However, Acme's failings began almost in the first minute of their operations, some of the unexpected but most of them predictable. In the meantime the balance of the project had been completed successfully and within budget and, following some change order approvals and other necessary paper work, Sammy's role as Project Manager was concluded. Although he moved on to other activities, Sammy was continually contacted by the company's Operations and Engineering departments to help them resolve some of the ongoing problems with Acme.

During the first few years of operation, Acme presumably did its best to satisfy the many plant requests for improvement to its system. Gradually, the spirit of cooperation gave way to animosity and the blame game. Providing the many system adjustments and tweaks proved to be very costly to Acme; on the other hand, the company never realized the potential value that a well designed system could provide. The company continued to be plagued by low quality products that did not meet market specifications.

No Winners

Finally, after five years of heated verbal and written exchanges involving numerous trials and negotiations with Acme, the company filed a long-anticipated lawsuit against Acme, contending that Acme had cost them several million dollars in lost revenues. Although litigation resolved some of the dispute, neither party was particularly pleased with the ultimate judgment, and once again the biggest winners were the trialers. However, Acme was not required to pay for any damages that had occurred as the result of the company's inability to satisfy customer requirements. In addition, the legal team that was hired by the company charged a substantial fee to prosecute the case for the company. Furthermore, the company still has an inefficient and costly system, due in large part to the fact that they were unwilling to work closely with the supplier. An obvious situation that should have never gone to court ended up being a lose-lose situation for both parties.

Summary: The one person, Stuart, who was in the best position to resolve the situation, had developed the attitude that the supplier should sink or swim on its own merits. Conversely, the supplier Acme refused to accept any external support, and may have been reluctant to accept any internal assistance as well. A number of mistakes were made, including the supplier being awarded a contract based on promises rather than on previous results, and the company being unwilling to offer any concrete solutions to the supplier's systems which were knowingly lacking.

Whether you are a salaried or contract employee, your position as Project Manager demands that you be dedicated to the best interests of the company that is paying you, no matter whether you are dealing with engineering firms, suppliers, contractors, or other company employees.

As a PM you are obligated to offer your candid opinion on critical matters, and to have both the knowledge and courage of your convictions. Should your employer choose to not heed your advice or recommendations, you still are expected to move forward with the project in the best professional manner possible. You will have demonstrated your sincerity by showing your concern; maybe the project won't turn out the way you would have hoped, but you at least maintained a positive outlook.

B. Large and Multi-National Companies

There was an experience by a young Project Manager who was relatively new on the job. Danny had been a supervisor at one of the company's plants and, when the plant was cutting back in production, was asked to transfer into the company's central engineering department. Within a few months of Danny's transfer, his leadership qualities and his abilities to motivate personnel were recognized by his superiors, and he was rather quickly asked to manage four smaller projects. One of the projects was ongoing and had an initial budget of \$4.0 million, but was on trend toward a 50% overrun. Interestingly enough, the original PM whose duties on this project Danny had assumed, had been promoted out of the project management group and into another engineering sector. Another project that had been assigned to Danny had just been approved by the company's board of directors for \$8.0 million and was scheduled to begin immediately. However, the company had made the decision to delay the second project pending the financial results of the first project when it was further along and executive management could determine its cost impact on the company as a whole.

Always Plan

During this delay, which turned out to be about six months, Danny provided a somewhat unorthodox approach to project management. He analyzed both projects and then proceeded to manage them as one project, even though they were at two different plants which were 2,000 miles apart. He requested an Advance Authorization of \$1.2 million for the second project, which was within company guidelines, in order to proceed with the necessary engineering to provide for long delivery equipment items and construction drawings and specifications. He also had a \$400,000 contingency allotted to the first project (also within company guidelines as a Change in Authorization), thus bringing the budget of the first project up to \$4.4 million. Danny then, with the second project underway, proceeded to analyze the cost structure of the first project in order to bring its costs more in line with the original budget without sacrificing quality or any other production values.

He started by eliminating a new office complex and slightly expanding an existing office that was only being partially utilized. He followed the same practices with an existing maintenance shop and utility building, thus reducing projected costs by several hundred thousand dollars. He had his engineering group rearrange and simplify the conveying system, which eliminated several hundred feet of conveying equipment at a cost of more than \$1,000 per foot. While these activities had been developing, Danny had been in

conflict with some members of plant management regarding the actual construction of the facility. The plant had awarded a “standing order” to a favored local contractor that had been given an open order for most of the construction in the plant, including this new project. Danny convinced Executive Management and most members of plant management that all capital projects must be competitively bid, and that the favored local contractor was welcome to submit a bid, along with the bids of at least two other local contractors. The resulting competitive bids produced prices that were nearly one-half of what the favored local contractor had estimated. The project met its startup date and, after all the agonizing about it breaking the budget, the final cost was slightly less than \$4.0 million.

Approval of 2nd Project

In the meantime the second project was progressing quite nicely – long lead equipment items were either on site or were close to being delivered, and construction specifications had been written, revised, and rewritten. In addition, all construction drawings had been checked at least twice and were ready to be issued. When Danny received notification to proceed with the second project, he and his project team were quickly able to secure construction contracts and begin the actual field work. The construction companies that were awarded the contracts on site already had available to them the necessary facility equipment available, thus avoiding any costly construction delays that had plagued previous projects of this type. The construction drawings had been issued in a timely manner, allowing the various contractors to order their necessary construction materials and have them also available for their crews. The original schedule had set aside 120 days from start to finish of the project; the actual time for the project was 88 days. Owing to the availability of the equipment and materials as well as to the accuracy of the drawings, there were no registered delays, nor were there any Extra Work Orders written for the first time ever on a project of this type. Primarily as the result of these savings in construction costs due to the diligence of Danny and his project team as well as the overall planning, the total cost of the project was slightly less than \$6.0 million, for a net savings to the company of more than \$2.0 million.

For weeks afterward Executive Management would send other PM’s and engineers to Danny’s office to hear his “words of wisdom” on how to bring their projects under budget and within schedule. As Executive Management continued to assign him to larger and larger projects, Danny never tired of repeating his philosophy: provide the engineering as early as possible and have the equipment on site before the construction begins. This simple philosophy meant that the Project Manager had to plan and prepare the work for which the PM was responsible, but also to understand the needs and requirements of others engaged in the project so that a successful conclusion could be achieved.

Summary: A quality Project Manager has a long list of objectives when starting or assuming a project. Regardless of experience or longevity as a PM, that individual must plan; that includes the budget, schedule, work force, plant or office management and personnel, and the scope as presented. If a PM fails to take the necessary time to review and plan a project, failure does unfortunately become an option. On the other hand many projects have become successful when a Project Manager comes to understand the nature of the project, listens to the wisdom of those who are involved, and moves forward in a positive, direct but not contentious manner. As you may have noted from previous case studies, other factors such as leadership and decision making are usually very important, but none more so than planning.

c. Defining Decision Making

Joe was a small-town boy from a community about 30 miles south of Pittsburgh along the Monongahela River. At the time when Joe was growing and developing into an athlete of some renown, Donora's only claim to fame was Stan Musial, the great baseball player for the St. Louis Cardinals. Most of Joe's family either worked or planned to work in the old Donora Wire Works when the time came. Joe and his friends probably spent a lot of their time playing the major sports of football, basketball and baseball, enjoying activities along the wide river – especially in the summertime – and proclaiming that the future held something better for them than the Wire Works. However, that was one decision that was taken out of the hands of Joe and his friends – the plant shut down permanently in June of 1962 at just about the time that Joe and his buddies were entering peewee league football. Although Joe did not have the greatest arm strength, the years of experience with his dad had taught him so much about the game of football that he naturally became a quarterback when he enrolled at Ringgold High School, a joint school district that was formed between Monongahela City and Donora when the plants shut down and the population declined.

Major Decision

Joe was no slouch as an athlete, even though he came from a smaller school. He was a Parade All-American in football in spite of his lack of arm strength, and was also an All-State basketball player. Joe was recruited by several Division One schools, but his first choice of where to accept a scholarship was at North Carolina State, since they had agreed that Joe would be able to play both football and basketball. However, his boyhood idol was Terry

Hanratty from nearby Butler, PA, who had led Notre Dame to a national championship in 1966, and was then playing for the Pittsburgh Steelers.

Joe chose the romantic over the pragmatic, making a decision to accept a scholarship to Notre Dame, where he had been recruited by Ara Parseghian. Joe was ineligible to play as a freshman, but when Parseghian resigned at the end of the season, Joe had the option of transferring to another school. Again Joe made a decision, preferring to stay at Notre Dame, even with a new coach and several recruits ahead of him at the quarterback position. Joe languished on the bench as an unknown entity for much of his sophomore year. Finally the new coach Dan Devine called on Joe on two occasions when both games were seemingly lost and Notre Dame was several touchdowns behind in the fourth quarter. All Joe did was to complete touchdown passes and pull out the victories for the Fighting Irish. Coach Devine still did not recognize Joe's capabilities and Joe remained as the third team quarterback at the end of the season.

Career Changing Decision

Preparing the next spring to battle for the starting position, Joe suffered a serious shoulder injury and had to sit out his entire third season. Joe still had two seasons to play, but knew that he was far down Coach Devine's depth chart and might not ever have an opportunity that he had dreamed about as a young boy. Nevertheless, he decided to rehabilitate his separated shoulder, and worked hard to get back into playing shape. In his junior year he was still listed as the third string quarterback and Notre Dame struggled to a 1-1 record. In the third game of the year, the team fell behind by three touchdowns. With Notre Dame losing its first and second team quarterbacks due to injuries, Coach Devine in desperation inserted Joe into the game in a nothing-to-lose role. Instead of being resigned to lose, Joe threw four touchdown passes in the fourth quarter and Notre Dame won the game. Afterward Coach Devine somewhat reluctantly named Joe as his first team quarterback, and he led them to a near perfect 1977 season, winning their last nine games. When Notre Dame defeated Texas in the Cotton Bowl, they were crowned the national champions, thus fulfilling one of Joe's childhood goals.

Fulfillment

In spite of Joe's many successes on the football field, he was not highly regarded by the professionals, was rated as low as the sixth best collegiate quarterback when he graduated, and was finally selected in the third round by the San Francisco 49ers. As a professional quarterback Joe had to make numerous decisions on virtually every play. Obviously Joe made many decisions, some bad but mostly good enough to win four Super Bowls, be the

Most Valuable Player in three of them, and be elected to the Pro Football Hall of Fame. Joe is only one of two quarterbacks who have ever led their teams to both an NCAA championship as well as a Super Bowl victory. Interestingly, the only other quarterback to have done that grew up in a community 30 miles north of Pittsburgh and is also named Joe.

Summary: Decision making is also a way of life for a Project Manager, just as it was with Joe. Although a small percentage of PM's come by these attributes naturally, the great majority of PM's and other managers develop the necessary skills for true decision making through personal experiences and instinct. Others may acquire it later in life through diligence and effort, including study and training. Irrespective of how you have managed to position yourself as a leader, know that leadership is one of the two or three greatest qualities of a Project Manager. As you go through this course in Advanced Project Management, you will note a few other important qualities for a PM, although none is more important to the success of your project than strong leadership

III. **Dealing with a Project Team**

A. **Matrix Organization**

Jennifer was the only daughter in a Midwest family that included three brothers, two older and one just a year younger. Her brothers played many different sports and, not surprisingly, Jennifer became an outstanding athlete, usually being the first one chosen in a family pickup game of football or basketball. She excelled on her high school basketball team and was granted a full scholarship to a southern university with strong academic credentials. Jennifer followed in the footsteps of an older brother and graduated with a degree in mechanical engineering, was easily accepted into graduate school, and received her master's degree in business technology one year later.

Jennifer received more than a few employment offers after getting her second degree, and opted for a large manufacturing company that had a strong reputation for growth and for promoting its management from within. Jennifer spent the first few years in the company's training program at their largest facility, followed by nearly three years as a Process and Project Engineer. Finally Jennifer was assigned to one of the company's medium-sized expansion projects as the lead Project Manager, and was to be given guidance by a Senior Project Manager on an as-needed basis.

First Significant Assignment

Jennifer had a pretty good idea who she wanted, or didn't want, on her project team right from the start. She was fortunate to have a Construction Manager with previous experience and a solid reputation assigned to the project by the vice president of engineering. In addition the lead civil engineer and primary mechanical engineer that she had selected were both available and anxious to do all that they could to assist Jennifer in making her project successful. However, she was stymied when she requested the personnel from the Electrical and Process Control departments that had been suggested to her by her senior advisor. Both departments were in demand throughout the company, and most of the lead engineers in these departments were involved in ongoing and long term commitments.

Needless to say, these were two very critical areas of the project, and the overall success of the project would depend in large part to the qualifications and quality of the personnel chosen as the leaders in these two positions. As a new PM, Jennifer chose her dealings with the managers of those departments cautiously but with determination. Being a team player was ingrained in her DNA and personality, so that she understood that she could not dictate company policy. She was expected to work within the established parameters of the engineering department, so she addressed each of the two department heads individually. In the case of the electrical department head, she was offered a younger, less experienced engineer; however, the department head promised to monitor his progress and performance, and to even replace him if the PM was not satisfied with his progress. When the meeting with the head of the process control occurred, Jennifer quickly realized that she was not going to be so cooperative. Her initial response to Jennifer was that all of her people were extremely busy, and that no one would be available to assist on Jennifer's project for at least 2 ½ to 3 months.

Maintaining a Positive Outlook

Jennifer began her project as she had seen her mentor and other project managers do; she scheduled a scope of work and planning meeting for the following Monday. The meeting lasted no more than one hour, and was attended by the individuals who had been assigned to her team as well as by two of the department heads with whom she had previous discussions. The electrical department head offered his apologies for not attending the meeting due to a prior commitment, but assured Jennifer that he would make himself available in the future. Conspicuous by her absence was the process control department head, who did not respond to the meeting invitation. However, an executive from upper management was in attendance, and seemed quite pleased with the progress of the project meeting.

As Jennifer had learned from her experiences in the project group, a Project Manager's primary responsibility is to define the initial project scope, budget and schedule for her

project team. After some brief introductions and her opening comments, Jennifer spent the last forty minutes of the meeting asking and answering any questions. As the PM she made a point of assuring them that they should notify her in the event that they encountered any problems, and that the schedule for issuing deliverables was very important. She was asked about the fact that there was no process control representative at the meeting, and she advised the team that this matter was being addressed by her. In the meantime she requested that each discipline stay within the guidelines of the original scope of work, and that they design the facility within those parameters. The member of the mechanical group then asked if there could be any flexibility in the final design. Jennifer displayed her confidence in the project team by stating that the initial scope of the expansion could have some flexibility in overall size and design, and that she would support their ideas and efforts.

Jennifer continued to move the project forward, holding informative meetings each Monday morning and issuing weekly progress reports to each team member, each department head, and to some selected members of executive management. At no time did she offer any criticism of anyone's individual performance, choosing to resolve any problems openly, but to recommend any changes or modifications on a personal basis behind closed doors. The project team and the department heads recognized her competence as a Project Manager, and worked hard to help make their project a success. Her mentor gradually let loose of any reins that he might have held over her originally and very quickly recognized that Jennifer had the maturity of a much more experienced Project Manager. Nevertheless, she usually accompanied the weekly progress report to the process control department head with a short note highlighting some assumptions that she and the project team had made, always indicating that she would be willing to make modifications if necessary.

Enthusiasm is Infectious

One Monday morning as Jennifer was beginning to start her second month on the project, into the conference room walked the process control department head. She had with her a 3-ring binder filled with Jennifer's meeting minutes as well as several pages of personal notes that she had been making regarding the project. About one-third of the way through the meeting Jennifer asked her to comment on the progress of the project and to offer any suggestions or recommendations. She was quite complimentary of the project team's efforts thus far, and then gave the team some precise information that she had apparently been developing, quite possibly since the first week of the project, but was only able to finalize the data over the weekend. She handed out specification sheets for the Data Center, which included numbers of work stations, servers and sizes, and the specification for the Clean Room. She also answered questions from the team's electrical engineer regarding

recommendations for standby power and fire protection. Furthermore she offered some suggestions regarding cyber security, an area that neither Jennifer or any of her other team members had considered.

Jennifer soon realized that the department head had been following the project almost since day one and had actually functioned as a part of her project team in absentia. The department head closed out her participation in the meeting by stating that Joe, one of her highly regarded engineers, would be available to work full time on Jennifer's project beginning the following week. In the meanwhile she would try to make herself accessible for any important issues that may arise.

Joe was in attendance at the next project meeting, had been almost completely versed on the status of the project by his department head as well as a review of the PM's weekly meeting minutes, and immediately proved his value to the project team's efforts. Jennifer was now feeling that the project team was settled, and great progress was made over the next four weeks. Final design parameters had been established, and bid packages were being sent out almost on a daily basis to building and equipment suppliers.

Consistency Does Not Require Status Quo

However, the mechanical engineer that had been assigned to the project was suddenly assigned to an emergency project in another location, again leaving a void that threatened the project's continuity. Once again Jennifer was faced with a mid-project dilemma, which she handled with maturity and competency. She requested a replacement for the engineer that had been reassigned and was offered a younger engineer that had only been with the company for less than one year. By this time Jennifer realized that the project team would often go through changes in manpower due to reassignments and various other reasons associated with a matrix organization, and would constantly be in a state of flux.

As the project passed through the purchasing phase and began its construction phase, Jennifer was appreciative of the fact that the Construction Manager was a consistent and steadying force for the project team and the project. He was an experienced hand who had been involved with several company projects, large and small, over the past twenty years. While he was respectful of Jennifer's directives, he did not hesitate to recommend a contrary viewpoint on an issue, which Jennifer truly appreciated. One of the many considerations that Jennifer, or any Project Manager, learns during the course of a project is the importance of a quality Construction Manager.

Summary: Jennifer had been with the company for over five years, had carried out her assignments effectively, and felt prepared to manage her first project. However, when you are dealing with a matrix organization that is involved in numerous projects all over the

country, selecting a project team can be difficult. To her credit Jennifer maintained a positive attitude, working well with the team members who were assigned to her project. She was very fortunate to have a strong Construction Manager assigned to her project team, a valuable member of any Project manager's team. Her patience and attitude afforded her the opportunity to receive a firm commitment as well as a comprehensive package of information from an unexpected source, the department head of process control. The company management always believed that Jennifer had the qualifications to become a strong leader and manager; now she had proved that she also had the necessary character.

B. Direct Supervision Team

Andy was in a unique position, whether or not he recognized the situation. He had just been named as the Senior Project Manager for one of the corporation's largest-ever industrial projects in the South. He was currently deeply involved with another somewhat smaller, but similar, project in the Midwest. The new project had just been approved by the company's Board of Directors, had a strict financial limit, and was expected to be on line and running at close to full operation within two years. In fact, the project had assumed such importance that Andy had been authorized to forego past practices of management jurisdiction and to report directly to the Senior Vice President - Operations of the entire corporation. While Andy was not too comfortable with this unusual arrangement, he did manage to maintain a relationship with his normal tier of management personnel, notwithstanding the fact that his new project was well into the ten figure range.

Choosing Your Replacement

One of the first items on the new Project Manager's agenda was whom should be chosen to replace him as the PM on his current project. There was some question regarding who should fill that position. The project that Andy was leading was, after all, the second largest capital project in the corporation. Andy, with the assistance of the VP, considered several names, including some in the central project management group, before deciding on Rob, a plant engineer with a strong operating and technical background. Although this was somewhat of an unconventional choice, Rob had made some valuable contributions to the project earlier. Rob also had a reputation for his willingness to go into the plant and assist operations and maintenance to solve problems. Rob proved to be an excellent choice as a replacement for Andy.

Choosing Your Project Team

Once that decision was made, Andy's next order of business was to select an associate who had similar values as Andy, had a strong work ethic, and could fill in as a moderator and communicator when the Project Manager was occupied with numerous tasks. The job would involve working with and motivating in-house engineers and designers as well as outside engineering firms. In addition much travel would be involved to many different parts of the globe, and several people throughout the corporation were given consideration for this position. Andy and his boss were in complete agreement that Rick was the right person for this position. Rick, a Senior Project Engineer in the engineering department, was extremely well educated, was still relatively young despite having extensive international travel experience, and had no particular family obligations. Andy and Rick worked very well together over the next two years, and Rick's performance earned him a considerable promotion following completion of the project.

As the PM Andy had the obligation to select a Construction Manager, and this critical position proved to be one of the easiest to fill. Jack was already on site at the plant where the new facility would be built. Although he had never managed construction on a project of this magnitude, he had been at the plant for nearly twelve years. Jack had been involved with numerous smaller maintenance and construction projects, knew the capabilities of the local workforces, and had been involved with many of the regional and national construction contractors. He and Andy and the other project team members worked closely together to assure that the project would be completed in two years.

Once the key pieces of the project team were put together, Andy and his two associates moved quickly to bring other quality personnel on board. They brought in young and vibrant engineers such as Gary, Ralph and Ned to fill the roles of Lead Project Engineers. They solicited Sue and Nelson from the corporate Purchasing Department to function as the project purchasing agents for the project team in order to circumvent any red tape that is sometimes prevalent in a large corporation. In this regard Andy realized that there would be some instances when he and his project team would have to work with preferred and sole-source suppliers. In those situations the Project Manager and his team would not have the time for the corporation's customary three-bidder process. Nor had the corporate purchasing department been willing to accept a higher bidder's proposal without a formal, written evaluation by the Project Manager and his project team. Because of the size and scope of the project, the project team had to justify the use of several particular suppliers which could supply products with a value that would meet the overall criteria of the project.

To further support the team's fast track philosophy, Bill and his assistant were placed on the project team to analyze the cost effectiveness of each major equipment item and to provide daily financial guidance and updates. Needless to say, many of these assignments created

controversy with department heads and other corporate managers. However, the Senior VP was firmly behind Andy's decisions, and constantly reminded the initiators of any complaints that there was nothing more important than this project. Gradually the complaining died down, and then stopped altogether.

Solutions and Communications

Andy truly believed that the project team had been chosen well and had great strength in all areas. He was constantly reminded by a friend of his, who was director of personnel for the corporation, that 10% of the people did 90% of the work. As the Project Manager he expected 90% of the project team to do 90% of the work, figuring that he could manage the other 10%.

One of the team's early obstacles was with the State Environmental Agency (SEA), which restricted their relocation of a nearby creek, demanded numerous data on air and water quality control, and even limited the amount of noise that could be made. Andy was really fortunate to have included on the project team a civil engineer who was versed in the rules and regulations of the EPA. She was able to prepare the necessary documents, have them signed by the proper corporate executives, and to satisfy each of the restrictions. All of these demands and limits were made in spite of the fact that the plant was on an industrial site and the nearest house was more than three miles away. Andy and his project team complied with every request by the SEA, responding clearly and quickly, thanks to her qualifications.

Andy held weekly meetings with his entire staff every Monday morning (when he was out of town Rick or one of the other Senior Project Leaders chaired the meeting). These meetings lasted no more than one hour, with the first half hour dedicated to status reports. The second half hour was used to air complaints or gripes among the team members. Common among the complaints as the project "came out of the ground" was that engineering was late with drawings, or that purchasing should be expediting critical equipment. Just as common was that construction was taking shortcuts with their installation practices. Andy tolerated a moderately adversarial relationship among the project team members, but usually arbitrated any contentious issues and resolved those issues or else had the conflicted parties schedule their own meeting to achieve a resolution. Andy or Rick usually closed those weekly meetings by reminding the Project Team members of their mission and objectives.

As the Project Manager Andy was more than willing to accept new ideas from such a highly qualified group that he was managing. He encouraged each of them to be flexible and to use originality, particularly if that meant saving time and or costs. For instance Andy attended a critical process control meeting hosted by his Process Control Team Leader. Also in attendance were two of the corporation's process control engineers as well as the manager of an outside process control company and two of his staff. Andy suggested that this group could develop a

unique design for the facility which would allow the raw product to become a finished product and shipped out the door without one button being pushed. In order to do that, the product would have to travel over one mile, or about 5,500 feet, under a roof structure that encompassed more than 22 acres. The group's first reaction was that it was impossible, but as they discussed the possibilities, their next reaction was that this was indeed a challenge. The group's decision when the meeting ended was that this was certainly something that they could do. In retrospect the final facility allowed the product to travel almost 4,000 feet before a button had to be pushed, but Andy had given that part of the project team a challenge that resulted in the corporation saving millions of dollars.

Delegating Authority with Responsibility

As the project gained in momentum, the Senior Vice President requested that Andy and his team prepare for a monthly status meeting that would be held on the first Monday of each month. Numerous corporate executives were invited to this meeting to learn about the progress of the project, and were also invited to tour the facility as it was being constructed. In addition to the corporate president, who attended several of the meetings, the executive list included the vice president of engineering, the vice president of commercial, and Mr. Lowell, who was the vice president of finance. While most of the executives were content to listen and learn about the status of the project, Mr. Lowell always reminded everyone in the meeting, especially Andy and his team, that millions of dollars in federal and state tax credits were dependent on achieving a successful project by a specific date. Andy usually chaired these meetings, but he often had one of his Senior Project Leaders make significant presentations as well as answer any direct questions. During the latter stages of the project, Andy was able to ascertain that his Construction Manager as well as Bill, his financial services leader, seemed to have an air of credibility that put the executives at ease.

Eventually Andy moved his staff of project engineers into different areas of the facility to support his staff of construction engineers, using both groups to certify equipment installation and operation, and to provide more firepower for the startup and fine tuning of the hundreds of millions of dollars worth of equipment. This portion of the project was done in phases, and was accompanied by significant and intensive training sessions with operations and maintenance personnel. Nearly all of these sessions were directed by Andy and his Project Team Leaders, with the ultimate result that the project was completed one month ahead of schedule and nearly ten percent under budget. Incidentally, the corporation apparently received all of the tax credits to which it was entitled.

Summary: Very few Project Managers will ever be involved in a project of the size that Andy was fortunate to manage, or to even have the direct support of the Executive Vice President

of the corporation. Nevertheless, there are several lessons that a PM can learn, regardless of the size of your project, when you are managing your own project team.

Andy kept his meetings short but consistent; he encouraged his project team to think "outside the box", but he always reminded them of their purpose and ultimate mission. While he advocated a somewhat adversarial relationship among his team members, he never allowed any animosity to occur, being quick to arbitrate any serious disagreements. And he encouraged each of his project team to be their own person, to offer solutions that would make a positive impact on the project, and to express themselves in front of corporate management.

C. Defining a Project Team

The six o'clock news had just come on the three major television networks, and people all over the U.S. who were fortunate enough to have television sets were straining their eyes at the black and white pictures which were being broadcast on the round screens. The early fall of 1957 had brought a surprise revelation from the other side of the world. The Russians (at that time they were known as the U.S.S.R.) had earlier launched a rocket into the earth's atmosphere, and it was carrying a Russian satellite known at that time with the name "Sputnik" that was orbiting the earth at speeds of nearly 18,000 MPH.

America was shocked into action, and that was the beginning of a "space race" between the Americans and the Russians that has essentially gone on to this day. NASA (National Aeronautical & Space Administration) was created and began a series of programs that were initially meant to catch up to the Russians. After a concerted effort by many engineers and scientists, the U.S. was able to put astronaut Alan Shepherd into space in the summer of 1961, and then to have John Glenn, also an astronaut and later a Senator from Ohio, orbit around the earth three times in 1963, in preparation for lunar flights and landings. During the activities of this initial space program, which was named Mercury, President John F. Kennedy made a speech to Congress in May, 1961. In that speech he called for America to put a man on the moon and have him return safely by the end of the decade, and NASA was off and running.

How to Get There

There was a great deal of uncertainty regarding methods for putting a man on the moon let alone being able to have him return safely to earth. The second phase of the space program was entitled Gemini. Its purpose was to place astronauts into an orbit around the earth in a command module which they would then launch toward the moon. Once close enough to the moon they would then send a lunar landing module down to the moon's surface, where the

astronauts would plant a flag, retrieve moon rocks and other souvenirs, and then return and dock with the command module as it circumnavigated the moon. This now may seem like a simple solution to a hugely difficult problem, but there were several ideas proposed over the next twelve months before the decision was made on how best to land a man on the moon, over many objections from within the Kennedy administration as well as from the NASA administration. One of those alternatives included the construction of a spaceship, vis-a-vis Star Trek.

Apollo was the third and final phase of the moon landing project, and it culminated when the Americans put the first man on the moon in July, 1969. That was an achievement of gigantic proportions, and involved many engineers, scientists, contractors and project leaders, and was the epitome of successful project management. The Apollo project lasted for about 11 years and was occasionally fraught with tragedy. A fire on board Apollo 1 during a training exercise took the lives of three astronauts.

Nine missions were planned to land men on the moon. Six were successful (11 and 12, 14 through 17), while the final two missions were cancelled due to budget constraints. The one unsuccessful mission involved Apollo 13 and the actions of an impromptu project team in 1970, which saved three lives and may have been one of the most remarkable accomplishments of the Apollo program.

Launch

Apollo 13 was scheduled to be the third lunar landing in the Apollo program, and was launched from Cape Canaveral on April 11, 1970. On board were James Lovell, the commander, Jack Swigart, the Command Module Pilot, and Fred Haise, the Lunar Module Pilot. The two main Saturn V rockets did not perform perfectly, but with some slight maneuvering they lifted Apollo 13 into an orbit 100 miles above and around the earth. Apollo 13 made 2 orbits around the earth, then fired its third Saturn V booster rocket and headed for the moon. In the 56th hour of the flight when Apollo 13 was approximately 205,000 miles beyond the earth's surface, and the crew just had a live TV broadcast from the spacecraft.

"Houston, We Had a Problem"

Haise was in the process of powering down the Lunar Module, and flight control in Houston requested that Swigart turn on the hydrogen and oxygen tank stirring fans in the Service Module. About two minutes later the crew heard a loud bang, followed almost immediately by variations in the electrical power and the firing of the attitude control thrusters. The crew's first inclination was that a meteoroid had struck somewhere on the Lunar Module. However, within a few minutes they quickly realized that an explosion had taken place in the Service Module, a

large separately docked module that provided power, oxygen, and water to the command module, and was also responsible for removing carbon dioxide and other human waste.

Investigation later revealed that one of the two oxygen tanks had exploded because of an electrical fire that had occurred due to a breakdown in the thermal insulation, and all the oxygen for the fuel cells was depleted in about two hours. The crew did not panic, and immediately shut down the emergency battery backup power system in the Command Module in order to preserve it for reentry back to earth. This meant that the crew would have to move into the Lunar Landing module for the nearly three day return flight back to earth, a premise that had been discussed several years earlier, but had been discarded as being impractical. The Lunar Module was designed to carry two men and support them for 1 1/2 days. It was now being asked to carry three men and to sustain them for three days.

Project Teams Swing into Action

Ground Control in Houston, Texas immediately recognized that a safe return from a lunar landing would be impossible under the circumstances, so Flight Director Gene Kranz gave the order to abort the mission, and thus began a series of events that saved the three astronauts' lives. The quickest abort plan was to use a direct trajectory by implementing the Service Module propulsion system, and its operation was now questionable. In addition this plan required the jettison of the Lunar Module, which was out of the question since the crew's survival depended on their using the Lunar Module. Another option was to burn the Service Module propulsion to depletion, then to jettison the Service Module. However, the Service Module provided thermal protection to the Command Module's heat shield and needed to stay docked to the Command Module as long as possible.

By this time Apollo 13 was less than one hour from the moon's gravitational field, and there was also concern regarding the structural integrity of the Service Module. For these reasons Director Kranz and his project team chose a circumlunar abort plan, which used the moon's gravity to in a sense boomerang the spaceship and return the spaceship toward earth with a catapult effect. A series of short propulsion system burns placed the spacecraft on an expedient trajectory that would have it land in the Pacific Ocean, approximately ten hours sooner than if its landing were to occur in the Indian Ocean.

Next Project Team Decision

The Lunar Module was powered by silver-zinc batteries and, although it carried enough oxygen to support the three-man crew, other consumables such as electrical power and water were at a premium. Considerable planning and experience were required by the crew, the flight controllers, and all ground support personnel to assure the crew's safe return. In order to maintain communications with ground personnel, the Lunar Module was powered down to the

lowest level possible, and an abort guidance system was used instead of the primary guidance system in order to conserve even more power.

Life-Threatening Decision

Another problem involved the use of lithium hydroxide canisters for the removal of carbon dioxide from the Lunar Module. The Command Module had an adequate supply of canisters, but they were not compatible with those in the Lunar Module. Another project team improvised a way to join the Command Module canisters, which were cone-shaped, with those in the Lunar Module that had a cone shape, by drawing air through a tightly fitted return hose.

Project Team Help from an Astronaut

Still another problem that had to be solved to ensure a safe return was providing a complete power-up of the Command Module, which had been completely shut down. Although this had never been done in-flight, Flight Controller John Aaron and his project team, which included grounded astronaut Ken Mattingly and several engineers and designers, devised a new way to do this with the spaceship's limited power supply and the time factor.

Final Critical Project Team Solution

Finally, the last problem to be solved was figuring out how to separate the Lunar Module a safe distance from the Command Module just prior to reentry into the earth's atmosphere. The normal procedure was to use the Service Module's reaction control system to pull the Command Module away from the Lunar Module, but the reaction control system was completely useless due to the power failure in the Service Module; furthermore, the inoperative Service Module would have to be released before the Lunar Module was undocked. To solve this problem Grumman Aerospace Corporation called on a project team of engineers and scientists from the University of Toronto.

Led by senior scientist Bernard Etkin, the six engineers on the UT team were asked to solve the problem in twenty-four hours. Using their slide rules (this was pre-computer), the team concluded that pressurizing the tunnel that connected the Lunar Module with the Command Module just prior to re-entry would provide the crew with enough force to push the Lunar Module a safe distance away from the Command Module. The pressure calculation was critical because too low of a pressure would fail to provide sufficient separation, whereas too high pressure would cause damage to the hatch and jeopardize the lives of the astronauts.

Re-entry, Splashdown, and Rescue

As Apollo 13 neared the earth's atmosphere, the crew first jettisoned the Service Module, using the Lunar Module's reaction control system to pull themselves safely away from it. In doing so,

they took several photographs of the Service Module, which allowed for assessment of the damages and future improvements of the fleet's other Service Modules. Then the crew jettisoned the Lunar Module, using the procedure developed by the project team from the University of Toronto. There was heightened tension by ground support personnel, as the usual blackout period upon entering the earth's atmosphere of four minutes without communications extended to almost six minutes.

However, the re-entry went smoothly and the Command Module splashed down in the South Pacific Ocean, less than four miles from the recovery ship Iwo Jima. The total flight time was almost exactly 6 days. The crew was safely on board the ship about 45 minutes later and in good condition, thanks to their training and expertise, and thanks to the ingenuity and capabilities of the many project leaders and project team members that were involved.

Summary: Arguably placing a man on the moon was the greatest achievement ever of mankind. The United States of America, less than 200 years old, had accomplished what most people felt was unachievable if not impossible. The effort, which had taken place over a twelve year period, was the result of the concerted efforts of politicians, project leaders, engineers, suppliers, and contractors.

The main difference between this gigantic achievement and the safe return of a crippled Apollo 13 spaceship was time. The many valuable members of the diverse group that made up the Apollo 13 recovery team had less than three days to bring a non-functioning spacecraft safely back to earth from the moon's gravitational field. The success of this accomplishment, particularly since this took place in the days before computers were established, was truly marvelous. The end result was, undoubtedly, one of the greatest project team efforts of all time.

IV. Negotiating with Insurance Companies

Sales orders were coming in at an almost frenetic pace, and the plant had increased its capacity by nearly 35% in the past four months. The plant was operating around the clock and seven days a week, with only an eight or ten hour shift each Sunday for maintenance and to give some of the equipment and operators a short rest. The furniture business was

prospering nationally as well as globally, and Smith & Jones, one of the largest furniture manufacturers in the world, was taking full advantage of the situation. In addition to their core products, S&J had recently developed a bedding product that had received much international recognition and could become one of their biggest sellers. This southern facility, although one of the oldest plants in the company, was being hailed for its productivity and was being heavily considered for the company's next large expansion project.

Call to Action

Then tragedy struck, and it struck very quickly. No one was sure how, but a cleaning tank filled with a solvent solution exploded and went up in flames late one night. The flames shot up high enough to ignite the roof structure, and before the local volunteer fire department could arrive and eventually put out the fire, considerable damage had been done to a significant portion of the building and most of the manufacturing equipment in that area.

Henry's bedside phone rang at 2:30 a.m., and on the other end of the line was the president of U.S. operations for Smith & Jones. Henry immediately sat up in bed, prepared for the worst. As Chief Engineer for S&J, he had attended many meetings with the president, and had had numerous conversations regarding the company's expansion program. However, he had never been called by the president in the middle of the night. The president quickly allayed Henry's concerns, assuring him that although a major fire had done significant damage to their southern plant, there were no casualties nor was anyone injured. Notwithstanding these assurances, the president strongly suggested that Henry visit the plant as soon as possible, make a determination as to the damage assessment, and bring the plant back into operation as quickly as possible.

That morning Henry was getting ready and, as he packed a small bag, called his office assistant to make an airline reservation with an open ended return flight. As he sat in the Atlanta airport waiting for his connecting flight (seems as though you have to go through Atlanta to get to any city in the South), he formulated general plans for moving as quickly as possible. Arriving at the plant later that morning, Henry assessed the situation and then held a detailed meeting with the Plant Manager and key operating and maintenance personnel.

After determining with the plant personnel what the scope of work entailed and visualizing the fastest means to accomplish a restart, his first phone call was to Don. Don was a Project Manager from a large multi-national engineering firm that had just completed an expansion project at a similar plant in the mid-south. Henry's second call was to his casualty insurance agent at Fairhope Mutual (not their real name). The agent at FM assured Henry that he would have an FM representative at the plant site very quickly.

Assistance from a Mini-Project Team

Don was on a plane that afternoon and met with Henry that evening. Henry expressed the company's need to bring the facility back into operation quickly, minimizing activities and eliminating any time delays or time constraints. After Henry and Don visited the plant the next morning and the smoke had literally cleared, they formulated a plan that they hoped would have the plant reconstructed and operating in less than six weeks. The plan included the utilization of used or borrowed or rehabilitated (where practical and probable) equipment. The fire had destroyed three bays, so each bay of the building would be rebuilt and the equipment repaired or replaced while the floor-based equipment in the other two bays was being replaced. Each of the other two bays of the building would be rebuilt in the same manner. Meanwhile the FM appraiser did not reach the plant site until four days after their phone call from Henry.

Much of the destruction from the fire was electrical, so Don had two electrical engineers and an electrical draftsman brought to the plant site to review existing electrical drawings, and to modify any drawings which did not reflect the "as built" conditions before the fire. In addition they were prepared to advise the electrical contractor immediately as well as to prepare sketches and to assist the contractor as needed. There was no bidding – all contracts were let on a time and material basis, and each contractor had performed a service in the plant within the past two years.

Steel beams were brought in from as far away as Houston and Chicago, using "exclusive use of truck" techniques to expedite deliveries. Two local steel fabricators were contracted to manufacture replacements for the building columns and truss work that had been destroyed in the fire. A building contractor from Birmingham was given the task of first removing the burned out roofing and sheeting, then removing or repairing the damaged columns, and replacing them as needed. Once the new or repaired columns were in place and the trusses had been installed, the roofing went on first, followed by sheeting half way down the building sides to minimize any interference from rain or wind.

Two mechanical contractors, working alongside plant maintenance personnel, were given the assignment of replacing damaged spindles, roll housings and rolls, and conveyor assemblies. Parts that could be repaired were reused, while spare parts were trucked in from at least five other plants. Most of the AC motors and some of the DC motors were replaced, but four or five of the DC motors had to be shipped to a repair shop in Atlanta to be rebuilt.

Damage Assessment

The Fairhope Mutual appraiser arrived late on the third night after the fire, and spent the entire morning assessing the damage that remained, reviewing the existing conditions as well as the numerous color photographs which Don had insisted that Henry and the Plant Manager take. That afternoon the appraiser met with Henry and the Plant Manager and listed the things that FM would not cover in their program. For instance, their policy did not have coverage for loss of revenue; this had been a foregone conclusion by S&J's legal group.

However, the appraiser then itemized a long list of other exceptions in the casualty policy that S&J never expected. Included in this list were such items as: all contracts had to have at least two bids and selection would be at FM's discretion; any work performed by plant forces would not be covered; and, finally, that no work could begin until FM had put together an estimate of total costs for repairs, which they would have in three or four days. Needless to say, Henry and the Plant Manager were very unhappy with FM's position, relayed the results of the meeting to executive management, and were told to continue with the repairs of the plant as had been planned.

Don had prepared a schedule that was monitored and followed very closely, and kept a meticulous account of all outside contractors. Henry and the Plant Manager kept an accounting of the plant labor force, and recorded each piece of equipment that could either be salvaged, or repaired and reinstalled, or replaced with new or used equipment. Sections of the fire-ravaged plant began to operate within four weeks, and the entire plant was back into full operation within another week.

Meanwhile, the FM representative had come back to the company about one week after the fire, had prepared another list of exceptions to their casualty coverage, and had offered to reimburse S&J in an amount that was approximately half of the amount that Henry and the Plant Manager had prepared. As the Project Manager, Don had also prepared a project cost, which did not include actual costs for plant labor, but did summarize all building and equipment repairs as well as his and the team's engineering costs, including travel and living expenses. None of these items were listed in the insurance company's proposed settlement, nor were they defined in the insurance fire and casualty policy.

Unsatisfactory Offer by FM

Executive management at S&J was extremely upset by the insurance company's low offer for a settlement figure and threatened to sue FM. The insurance company, confident in their interpretation of S&J's casualty policy, requested that each company select an outside representative to meet and try to resolve any dispute prior to S&J filing a lawsuit. Henry made Don aware of this situation and asked if Don, as the PM, could intervene on behalf of S&J as a representative in a preliminary arbitration-type hearing. He assured Don that

regardless of the findings by the two representatives, their conclusions would be taken very seriously but would be non-binding. Don had experience negotiating with insurance companies, and had also seen occasions when issues could not be settled, lawsuits had been filed, and law firms were the eventual winners. Don agreed to represent S&J, but asked that the meeting be delayed for two weeks in order to give him time to review all repair bills and also the terms of the insurance policy coverage.

Don and his project team, with some aid from his office accountant, spent the next several days documenting and assembling all costs associated with the repairs of the fire-damaged facility. He also reviewed the insurance policy that the furniture company had with FM. Don was surprised when he noted that the annual premium was so low, until he read what was excluded from the coverage. As he had been told previously, there was no indemnification for loss of revenue.

Furthermore, there was no stipulation that management salaries and labor wages were to be paid during the period while the plant was idle. This would be, in Don's opinion, one of the major sticking points of the negotiations with the insurance company. Although S&J was not claiming any management salaries in their insurance settlement, there were several hundred hours of labor wages in their claim. This portion of the claim also included a substantial amount for overtime pay as well as for the cost of materials and either in-house or rental equipment.

In addition the policy clearly defined that the insurance company would have authority to approve all outside contractors, with the simple stipulation that the company could recommend any contractors that had performed similar work at any of the company's plants in the past ten years. Don did not believe that this would be an item of particular contention, since the plant had a reputation for using the same contractors year after year, nearly all of whom were usually the low bidders.

Negotiations Begin

During the two weeks while Don was gathering all of the cost factors associated with the fire damage repairs and evaluating the insurance policy, there was a great deal of rhetoric by both parties. Lawsuits were being threatened and counter-suits were being considered. Even though the plant had had a very successful restart and was back to where it was before the fire, the air was very heavy, and neither side was talking to anybody but their lawyers.

Don stepped into this acrimonious environment on the appointed day, determined to do his best for the furniture company, but unwilling to compromise his ethics or values. As he sat there in the plant conference room that morning, surrounded by financial documents and makeshift photo albums, he still had a feeling of apprehension. Don was pleased to see only

one person appear at the meeting from the insurance company, and was even more pleased when he discovered that the insurance company had sent a former construction superintendent with many years of construction experience. However, Don soon realized that this individual had been employed by FM as an expert witness on numerous occasions, was completely versed in the rules and regulations of the insurance company, and that he would certainly be no pushover.

FM Considerations Did Not Seem Practical

The first item that they discussed was the repair and replacement of the buildings. FM had gotten bids from two fabricators for the building steel which were actually higher than the prices that had been submitted by the furniture company. While the insurance company numbers did include replacement columns and trusses, it did not include the many thousands of pounds of purlins and girts and other support material. In addition FM was proposing lighter gauge material for the roofing and siding, and Don pointed out that this was not replacement in kind as was stipulated in the policy documents. After about two hours of back and forth deliberations, the insurance representative and Don agreed to add slightly over \$2 million to the present insurance company offer.

The next major item for discussion involved the repair and replacement of the operating equipment that had been either damaged or totally destroyed in the fire. The insurance company numbers were surprisingly close to the figures that Don and Henry had developed, although for completely different reasons. FM was offering to replace all damaged equipment with new, off-the-shelf equipment, whereas C&J had repaired much of the damaged equipment and was asking for only about 2/3 of what was being offered.

However, the insurance company had prepared their estimate using a low bid outside contractor instead of plant labor forces, which was about 2/3 of the value that he and Henry had placed on that portion of the work. Lunch was brought into the conference room, and during their lunch hour the two parties agreed that this issue would be a net zero compromise.

The last major hurdle, which was the damage to the electrical systems, proved to be the most difficult issue to resolve. FM had not really prepared an estimate for the electrical system repairs, but rather had simply put a price tag of about ten percent on their overall settlement offer. However, Don and his electrical team had prepared a very detailed estimate, which included new control panels, motor starters, limit switches, solenoid operators, and the like. This number alone for electrical equipment and setup was more than FM was offering in their settlement figures.

Furthermore, Don had actual numbers from the electrical contractors (two were utilized in order to expedite the work). Not counting an assist by the plant labor force to set the electrical equipment and make the final adjustments, the actual cost that Don and his team presented to the insurance company was nearly \$2 million more than what the insurance company had proposed. When the insurance company representative was presented with this number for the electrical work that had been detailed by the electrical project team, he asked to be excused from the meeting for a few minutes and headed for the nearest quiet place to make a phone call.

Decision Time

The insurance company representative was gone for several minutes, finally returning to the meeting with Don after about one hour. In his hand he held a piece of paper with several numbers on it, which appeared to Don to be as the result of his phone conversation with someone of importance at the insurance company. The numbers represented an offer by FM for a settlement that was nearly 85% higher than their original proposal. While Don felt that the offer was very fair, he realized that it was still more than \$1 million below the request by C&J and would require final approval by their executive management in order to make it a binding agreement.

Don excused himself from the meeting and went to find Henry and the plant manager. He presented the insurance company offer of settlement to them, reminding them that the plant had been able to get back to full operation probably a month and a half sooner than could have been expected if they had followed insurance company regulations and protocol. As the result of expediting the reconstruction by that amount of time and being able to get back into full production so quickly, they had likely been able to generate more than \$2 million in revenue.

The two C&J personnel asked Don several questions related to the all-day meeting that he had been in, finally asking him whether or not he thought that the settlement offer by FM was fair. When Don stated that he thought it was very fair, the plant manager gave his approval to the reworked settlement offer. He had apparently been authorized by the furniture company to make the final decision on the insurance company offer, since they were dealing with his plant,.

Don went back into the conference room, notified the insurance company representative that the plant had accepted FM's offer, and reviewed with him the terms of payment. Two weeks later the furniture company received a lump sum certified check from the insurance company for the agreed settlement amount at their home office. Don was praised by the furniture company for his professional efforts, the firm continued to receive additional

contracts from C&J, and Don was promoted to Division Manager at his engineering firm a short time later.

Summary: The furniture company was fortunate to be able to recover from such a near-devastating situation that occurred. Henry, the company's Chief Engineer, was obviously a 'take charge' person, but neither he nor anyone else in the company was apparently aware of the limitations of their insurance policy.

While no one person or company can predict a fire to the extent that C&J experienced, the company could have changed their policy coverage once they realized the importance of their continuous operation. Calling on Don and his team was seemingly their best course of action (after the fact) in lieu of filing a lengthy and costly lawsuit.

As the Project Manager Don utilized all the skills of a quality PM to assist in getting the plant back into operation. Furthermore, he demonstrated his initiative and flexibility by going beyond his personal responsibilities. By getting involved in other aspects of reconstructing the fire-damaged areas, he thus made himself an invaluable asset to the furniture company. Don's first-hand knowledge of the repair work involved as well as his understanding of the limitations of the C&J insurance policy allowed Don to have favor with the furniture company. Furthermore, his prior experience in dealing with casualty insurance companies prepared him for the task and obviously saved the furniture company several million dollars.

Advanced Project Management II

1. Which of the following items is least important when evaluating a proposal for engineering services?
 - a) Total hours estimated to complete the project successfully.
 - b) List of prior experiences for each project team member.
 - c) Hourly rate charged by the engineering firm for a mechanical or electrical draftsman.
 - d) Previous similar projects performed by the engineering firm for that company.

2. Which characteristic is not conducive to a successful project?
 - a) Being flexible.
 - b) Having a teachable spirit.
 - c) Taking the initiative.
 - d) Being argumentative and contentious.

3. When Project Managers feel that they are being second-guessed by the management of the engineering firm for whom they work, they should:
 - a) request a meeting with that firm's management to resolve any issues and to gain their trust.
 - b) air their grievances to a client representative.
 - c) tell the project team members that their employer is being unreasonable.
 - d) be argumentative and stir up controversy.

4. Some common business mistakes that a Project Manager may be exposed to when working with a young and ambitious engineering firm.
 - a) Employees that may lack certain ethical standards.

- b) Firm that tries to grow too rapidly and takes on greater financial burdens.
- c) Firm that doesn't properly and meticulously evaluate its bids and proposals.
- d) All the above.

5. One of the most important items to consider when a Project Manager assumes an ongoing project is:

- a) Where did the former Project Manager go?
- b) What was the former Project Manager lacking and how could the project be improved and better managed?
- c) How much was the former Project Manager being paid?
- d) Which of the project team members did not particularly like the former Project Manager?

6. When Bruce met with the executive management of the industrial company in an attempt to salvage an already damaged project, what qualities did he not exhibit?

- a) He was honest and sincere.
- b) He was open to lines of communication.
- c) He was objectionable and haughty.
- d) He offered no excuses for past performance by the firm.

7. One of the biggest complaints which the client had about the former Project Manager was that he:

- a) did not get along well with his project team.
- b) was uninformed about their industry and the client's objectives.
- c) never visited the jobsite.
- d) always took Friday afternoons off.

8. Which of these statements is false concerning a quality Project Manager?

- a) A quality Project Manager should never accept an assignment unless the take home pay is very high.
- b) A quality Project Manager should always remain alert to new and greater opportunities.
- c) A quality Project Manager should be able to properly manage nearly any type of project.
- d) A quality Project Manager should always remain loyal to both the client and the engineering firm.

9. Strong leadership in a Project Manager is considered:

- a) a way of life.
- b) a state of mind.
- c) important to a successful project.
- d) All the above.

10. As soon as Sammy realized that the process and ideas expressed by the management team were different from his experiences, he should have:

- a) Injected his own ideas and preferences in the meeting.
- b) Expressed to the management team that he was confused.
- c) Remained silent and listened closely to their explanation.
- d) Turned in his notice and looked for another project.

11. Whenever the Project Manager is confronted with a situation whereby no single supplier can furnish all of the equipment listed in the specification, the PM should:

- a) Take the vendor's word that it can meet the specification.
- b) Change the specification so that the vendor can be compliant.

c) Segregate the specification into more than one specification so that vendors can be compliant and experienced with the item(s) they are bidding.

d) Cancel the project.

12. What recourse does a Project Manager have when there is disagreement with a company representative regarding expectations from a supplier?

a) Remind the supplier that it faces a potential lawsuit if it fails to meet the specification.

b) Express your concerns to the company representative and validate your reasons, then continue on with the project.

c) Try to find someone in the company above the company representative who may be more sympathetic to your concerns.

d) Point out in your weekly status report that you disagree with the company representative on this issue.

13. Irrespective of whether your ideas and philosophies are always accepted by the company which a Project Manager represents, you are expected to:

a) adopt the company ideas without any questions.

b) show little or no interest when critical suppliers produce certified drawings.

c) continue to be dedicated to the best interests of the company that is paying you.

d) notify your project team members not to be concerned regarding the certified drawings that they are receiving from the suppliers.

14. Although the company representative did not want the Project Manager to make any corrections to Acme's design, Sammy did invoke a common sense initiative by:

a) changing the sizes of the pumps that were specified.

b) modifying the certified drawings that Acme had issued.

c) increasing the sizes of the cooling towers that were specified.

d) limiting the amount of damage that an open water system could cause.

15. One of the most important things that Danny accomplished while bringing the first project within budget was to:

- a) manifest significant changes in procedures over the objections of some of the plant personnel.
- b) follow the same practices as the previous Project Manager.
- c) accept the idea that the project was over budget and that nothing could be done about it.
- d) be sensitive to any criticism if his unorthodox ideas did not work.

16. As the Project Manager, Danny received many accolades for bringing the second project significantly under budget and well ahead of schedule. What secrets did he share with other PM's regarding his success?

- a) He planned the two projects as though they were one, and had no fear of failure.
- b) He established a plan to bring both projects within budget, and was not intimidated by circumventing past practices or plant personnel.
- c) He wisely utilized the company procedure for advanced authorizations to order long lead items and to have certified construction drawings prepared.
- d) All the above.

17. Joe faced many decisions during his Hall of Fame career, beginning when he was a teenager and extending through his college and pro football careers. What one thing would you think most propelled Joe to the successes that he had?

- a) He felt limited because he grew up in a small mill town.
- b) He was satisfied to be on scholarship at a major university, even though he was a third string quarterback.
- c) Joe felt lucky to be drafted in pro football because of his weak arm strength, and never expected to be more than a backup quarterback in the pros.
- d) He never wavered in his desire to be the best that he could be and always had a positive attitude

18. When dealing with a matrix engineering organization, the Project Manager should:
- a) be able to dictate who will be on the project team.
 - b) expect the most qualified engineers and designers to be on the project team.
 - c) keep the department heads as well as the project team members apprised of the progress of the project.
 - d) be resentful and discouraged when requested personnel are assigned to other projects.

19. Jennifer proved that she was qualified to be a Project Manager because:

- a) she went to college on a basketball scholarship.
- b) she maintained a positive attitude in the face of adversity and developed a strong line of communication with all who were involved in the project.
- c) she established a sense of self-pity when things did not go her way.
- d) she determined that PM's could not cope with the problems created by having a project team that was constantly fluctuating.

20. Jennifer displayed her confidence in the project team by:

- a) allowing them the flexibility to determine the overall size and design.
- b) not showing concern for the missing process control engineer.
- c) holding up the project whenever she did not have a complete project team.
- d) all of the above.

21. One of the most important variables that helps to make a project successful is to:

- a) be on good terms with the head of the purchasing department.
- b) follow the guidelines and desires of the senior members of the project team.
- c) have an experienced Construction Manager as a member of the project team.

d) be unwilling to accept inexperienced engineers on the project team.

22. Some of the principles that a Project Manager should follow when selecting his project team members include:

a) picking your closest friends, because you can rely on them.

b) choose those personnel who have performed well for the Project Manager in the past.

c) interviewing those personnel in the corporate database that want to work on the new project and make the most promises.

d) check with each department head to determine who has the lowest salaries.

23. Two very important steps that Andy took to accelerate the project were to:

a) Hold weekly status meetings with his project team and monthly meetings with executive management.

b) Include experienced purchasing and environmental personnel on his project team.

c) encourage contractors to begin construction without certified drawings and to take short cuts.

d) work a standard 8-hour day and a 5-day week.

24. While Andy as the Project Manager bore the primary burden for the success of the project,

a) he delegated much responsibility as well as authority to his Project Team Leaders.

b) he relied heavily on the Executive Vice President whenever a crisis occurred.

c) he was quick to blame the project team members when things went wrong.

d) he often criticized the construction contractors when schedules weren't met.

25. Because Andy felt confident that he had selected a highly qualified project team, he was willing to:

a) allow them to alter the mission from time to time.

b) accept new ideas from them.

c) take short cuts if they could save the project money.

d) moved some of them into the field in order to watch over the others.

26. Not many projects that we encounter or in which we have involvement are life-threatening, but one characteristic that enabled Gene Kranz, the Flight Director, to bring Apollo 13 to a safe return was that:

a) he knew exactly what to do and made all the decisions.

b) he followed all the written guidelines for what to do when a Service Module fails.

c) he called on the expertise of many project team members before making any critical decision.

d) he was anxious to determine what had caused the explosion on the Service Module.

27. What made the safe return of Apollo 13 such a remarkable achievement was that:

a) there were plans in place in the eventuality that there would be an explosion on the Service Module.

b) there was a limited amount of time in which the project team could react before the power was completely drained.

c) they failed in their primary mission to land another man on the moon.

d) the Apollo 13 program was in trouble and probably would have been scrapped.

28. Although Henry, the Chief Engineer for the company, acted expediently and with resolve, he and several of the company's management were derelict for:

- a) not knowing that a fire would result in extensive damage to the plant facility.
- b) not having their own fire department readily available should such an event occur.
- c) not having an understanding of the limitations of the fire and casualty insurance policy.
- d) not sending a company representative to Fairhope Mutual to review the policy with them.

29. Don, a Project Manager, was not expected to know about the list of exceptions contained in the insurance policy. However,

a) his experience in dealing with accidents that caused considerable damage prepared him for the task that he was asked to perform.

b) his detailed record of the actual work performed allowed him to offer an accurate account of the activities necessary for the company to recover from the fire.

c) Don's use of a mini-project team of electrical engineers, and their production of drawings as well as their record keeping of damaged electrical gear, proved to be a valuable asset during the final negotiations with the insurance company representative.

d) all of the above are true.

30. Don's primary objective as a Project Manager was to:

a) negotiate a settlement for the company with the insurance company.

b) keep a meticulous record of all the material and equipment that was damaged in the fire.

c) get the facility back into operation as soon as possible.

d) show the company how important his engineering firm was to them.