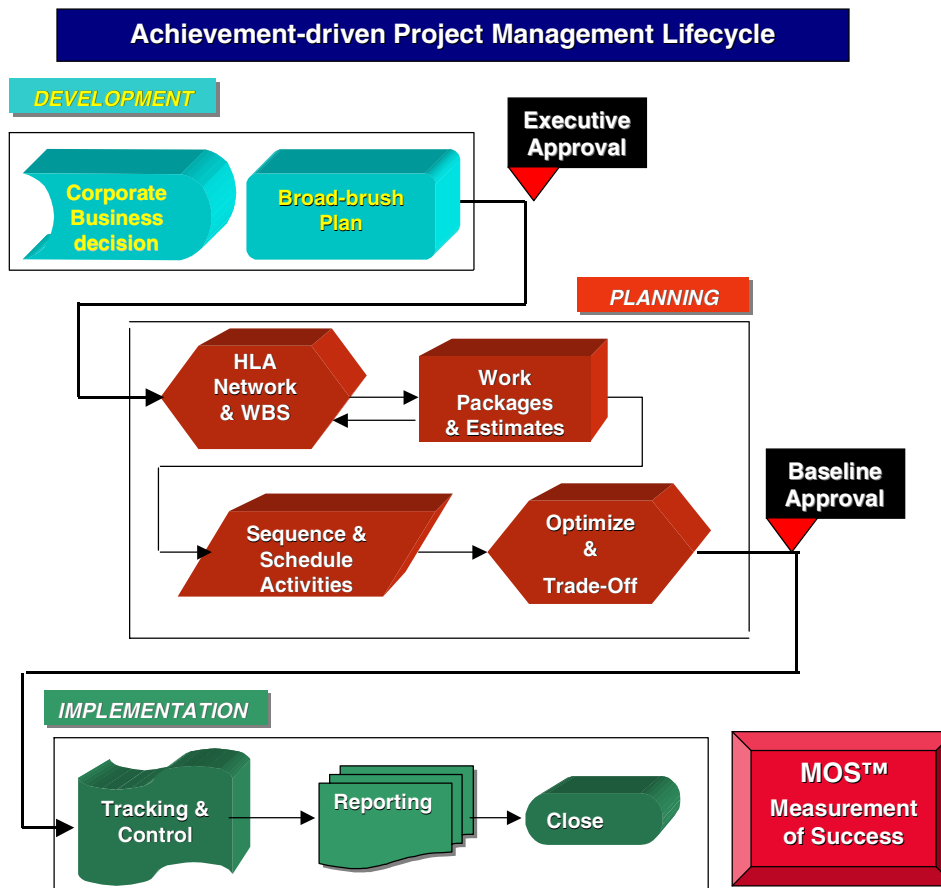


Engineering & Construction Project Management



By Mike Angerame
& Dick Billows

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1 - Lessons Learned

We will begin by sitting in on a "lessons learned" meeting for a failed Engineering/Construction (E/C) project. Though a gloomy way to introduce the topics we're going to cover in this book, it gives us an inventory of many of the PM problems that are all too typical in today's project management environment. After all, the point of this book is to help you avoid each and every one of them.

Our project manager waited in one of the new conference rooms they had built, doodling with a green fountain pen in the margin of the "Lessons Learned" document, sketching figures of project managers hanging from a noose. He had notified all the project's players of the meeting but everyone was late, just like during the project. A few project team members, professionals and subcontractors straggled in. The PM received crisp nods from some team members but many just went to their seats, eyes downcast. They'd all worked pretty hard. But their hard work had produced little but association with a failed project. Oh, there were a few who goofed off and played some games with estimates and change orders. But the resentment on most of their faces clearly signaled that they blamed him for the failure.

The clients tromped in as a group led by the VP who'd had almost no involvement at the beginning of the project and whose time investment grew exponentially as deadline after deadline was missed.

"My gosh, yet another meeting," The VP sneered. "We're still trying to fix the mess! If anything, the number of customer complaints about the facility is even higher than before we started this disaster. "

The PM capped the fountain pen, thinking that this was a wonderful way to begin the meeting and said, "Well, the idea of the lessons learned meeting is to try to identify what went wrong so we can improve the way we do projects."

"You people," the VP snapped, "have to do a lot better! We cannot keep having these project disasters."

"We delivered every requirement you specified," barked a contractor, already red in the face.

The VP snapped back, "Go tell that to the customers who are still complaining."

The PM knew it was time to regain control of the meeting. "One of the problems with our planning was that we didn't focus on reducing the problems that cause the complaints. In the beginning, we only talked about specifications and layouts that you wanted. Then the list of requirements kept growing every week."

From the expression on the faces of the customer's people, the PM knew the last comment was a mistake.

"It kept growing because you never gave us what we wanted," one of them said.

The VP pushed back from the table and stood up, "This is getting us nowhere!" Then the VP pointed a finger at the PM's face and said, "You were seven months late and \$300,000 over budget and we still have the same problems in the new facility that we had in the old one."

The VP turned and took two steps toward the door before whirling back and saying, "And what I like the least about the way you people do projects is that all the bad news always comes at the end, when we can't do anything about it!"

BAD SURPRISES WHEN IT'S TOO LATE

As the project team and customer group continued the debate, the PM thought about the VP's last words.

There had been a lot of bad news late in the project. Sure, some of it could be attributed to overly optimistic estimates and some to scope creep. He also wished that several of the contracts had included a bit more "carrot and stick" in them. Several of the time and materials contracts had been killers and an open invitation to change orders he was all but powerless to control. As the completion date kept getting pushed out, his staff and the customer's people got real nervous about reporting problems and tried to hide slippage and overruns. When he found them or they eventually came to light, the sky fell on the internal staff from all quarters. Including, the PM had to admit, from him. Although they should have been honest enough to report problems, he knew he could have done a better job accepting bad news and protecting them from executive tongue-lashings. Getting bad news was better than not hearing about it because then no corrective action was possible. Another real problem was not having the tools to spot small problems early. With the project plan they had built, both the team members' status reporting and Jack's reporting to management and the customer were too vague until near the end.

A supervisor's angry voice broke the PM's reverie.

"We never understood that technical mumbo jumbo you made us sign off on! Signing a list of specifications when you don't understand it means nothing."

We need processes supported by tools that forecast problems early not just report them after the fact when it's too late to consider options.

"Well if it meant nothing, why did you keep adding to the list each week?" A foreman snapped back. "If you want these projects finished on time you can't keep changing things!"

CHANGES, CHANGES AND MORE CHANGES

Both the foreman and the supervisor were right. Sure, they'd tried to "freeze" the specification and they'd gone through a very thorough approval and sign-off process on the technical specs. But then every week the list of features and changes grew. The customers would see walls go up and say, "This won't work for us the way you've got it." Then the project team member would say, "Well, I'll have to fill out a change request because that's a change and it'll take more time and cost more money." The two would go around and around debating whether this was or was not a change and it would be escalated. Then the same debate would occur at a higher level with everyone becoming more and more angry. Most times the change was added to the plan but usually without sufficient increase in budget or duration. That gave the contractors all kinds of reasons for finishing late. If he insisted on budget and duration increases to reflect the cost of a change in the project, the team was blamed for doing a poor job of laying out the specifications.

The fact was the customers did not understand the technical language and there was very poor linkage between those technical requirements and the improvements in operating performance. It was also true that neither he nor the team had a clear understanding of the business and performance results the customers were seeking from the project. Of course, at the beginning the customers did not seem to understand what success was either. In fact, their part of the effort, beyond a vague mention of changing their processes and workflow, was not part of the plan. There was tremendous pressure to get started and little interest in integrating customer process changes into the planning.

Another loud voice, "The work was shoddy!"

"We didn't do bad work," a contractor retorted. "You didn't decide what you really wanted until we were almost done."

The PM had to admit that there had been some problems with quality that didn't come out until near the end. But there had been so many changes throughout the project that they'd cut back on the time allocated to testing and inspection. The result was serious flaws that came to light during the acceptance phase and had to be fixed on top of another round of customer changes. Those changes late in the game were really expensive and cost hundreds of times what the same changes would have cost earlier.

A field engineer, whose face was an ugly blotch of red and white, finished shouting at the customer and stormed from the room. He knew the engineer had worked very hard on the project, spending a lot of evenings and weekends to get the work done.

PROJECT TEAM WANDERING IN THE WILDERNESS

As everyone watched the violent exit, the PM scanned the angry frustrated faces of his project team members. They were a pretty good group. The PM speculated that many would be gone before the next project. The original completion date had been "plucked from the sky" before the PM had even been selected as project manager, much less done any analysis. He argued about the date but got nowhere trying to convince the executives of the impossibility of reaching it. As a result, the duration and many work estimates were jokes and everyone on the project team knew they would fail to hit the due date before they even started work. They had no commitment to their individual due dates. The situation got worse when the customers kept adding new requirements with few increases in budget or duration.

They planned the first few elements of the project with a lot of clarity but the rest was murky, to say the least because they had no clear business outcome at which to aim. As a result, a lot of time was wasted each week with a continuing effort to complete the plan and there was poor integration between the construction effort and the customer's operational changes. It was like they had several separate projects that never got tied together. Many customer activities that should have started early in the project, dropped by the wayside.

Just then, one of the customers raised the 60 page project plan over her head and threw it at the garbage can, missing by four feet and scattering Gantt charts all over the floor. The PM looked at all those Gantt charts fluttering to the conference room floor and wondered if the project plan had been a little too detailed. They started the planning with a lot of talk about the business outcomes and clear direction. But all the pressure to get started with the work led to the project plan being little more than a very detailed list of E/C micro-activities. Was that micro-management, he wondered? And the plan had not really specified the things required from the customer, like process changes, training and staffing. Either way the project plan had been useless. They weren't but two weeks into the effort when people started saying, "We've already done that" or "we can't do that yet because..." so all those details in the project plan really didn't provide the project team with guidance. And some of the more experienced people seemed to make a point of doing things in sequences other than what was laid out in the project plan. They

Team members who have to guess the end result that is expected don't give us their "best work" nor do those we micromanage

explained that they'd found a better way to do it but the PM often felt that their point was just doing it differently than the plan.

In the still rapidly deteriorating lessons learned meeting, a designer screamed, "Why didn't you tell us in the beginning about the big problem with customer complaints?"

"We did!" chorused the three remaining people from the customer area.

"Oh, you mentioned it but two-thirds of what we did had nothing to do with reducing customer complaints."

The customer said, "But as long as you were making changes, we wanted to fix everything that was broken."

STRATEGIC PLANNING

The last customer walked out of the meeting followed shortly thereafter by the last two members from his team. That last exchange captured the essence of the project. As dumb as it sounded, they had done a great deal of irrelevant work and it wasn't until toward the middle of the project that they really understood the business objectives for the new facility and how the customer would measure the business success of the project. He sighed in exasperation. That lack of understanding of the customer's business purpose had also made change control impossible. Instead of being able to evaluate the change requests on the basis of whether or not they contributed to the desired business results, they were left with only the ability to argue about changes and specifications.

He wondered what they could have done differently. During the planning, the VP hardly gave them a moment of time; delegating planning to lower-level decision-makers who were equally unaware of the criteria that would be used to judge the project success. Why wouldn't the VP give them any time? Probably because every meeting they ever had with the VP was devoted to detailed engineering discussions that simply were not of interest to that level of decision-maker. Instead of setting up a network of business achievements and integrating all the pieces, he settled for mission statement mush. That was approved because there was nothing in it but vague generalities and resolved none of the conflict among the customer decision makers on the objective in building the new facility.

He tiredly rose and left the room, thinking two thoughts. First, that this happens to us over and over again but we never learn any lessons from it. Second, wouldn't it be nice if we had a better way of doing things.

ACHIEVEMENT-DRIVEN PROJECT MANAGEMENT

We'll develop techniques to address these problems in the remaining chapters of this book. The foundation for these techniques will be our Achievement-driven Project Management Methodology (AdPM™). We build this foundation with unambiguous business achievements that define success for the project as a whole and each of its components before we start. Measured achievements require that we think about end results rather than just activities, before we start work. But the payoff for the PM who makes this intellectual investment comes each week in the form of:

- ❑ *Team members who know what is expected of them before they start work*
- ❑ *Executives who understand what they are “buying” from the project and, as importantly, what they will not get*
- ❑ *Scope and change control processes that are based on hard-edged data not opinion*
- ❑ *Small project plans that are easily maintained and updated so the PM knows exactly where the problems are.*

It is normal for all of us to think in activity terms; what we want people to do. To conceive measured achievements we need to go a step further. We think about what we want people to do and then how we will assess their performance when they are finished. It is this later measurement that is our measured achievement. Let's consider a few examples of activities and their conversion to measured achievements:

| Activity | Measured achievement (success definition) | Type of Measured Achievement |
|------------------------------------|--|---|
| Complete design | Building Committee approves design | Approval achievement |
| Cooler installed | Cooler maintains 73 degrees with outside temp >95 degrees for 6 hours | Metric |
| Close in shell | Building shell meets specifications in Work Package 1-17-6 | Yes/no achievement with reference to detailed specification or a work package list of measured requirements |
| Train the maintenance staff | 90% of maintenance staff score 80% or higher on written test of new procedures | Metric |
| Install efficient packaging system | 85% of customer orders packaged and labeled in less than 120 seconds | Metric |

While the measured achievements in the middle column are in a number of forms, each gives us, or the person doing the planning, estimating or work, a clear and unambiguous performance expectation. It tells them when they are done and also makes clear what level of performance is good enough. For an executive, measured achievements detail what they are getting and also what they are

not getting. By laying out our plan we quantify expectations before we start work, not halfway through which is a real asset in scope control. Consider the maintenance staff training above. Laying out this clear end result tells the trainer the standard that the training must meet. It also tells an executive how well the maintenance staff will be trained and if that level is not good enough we can change the plan now rather than having to redo the training later.

Let's look at how we'll use this measured achievement thinking in our project management process.

MEASURE OF SUCCESS (MOS™)/HIGH-LEVEL ACHIEVEMENT NETWORK (HLA™)

The biggest measured achievement in our plan is the measure of success. It quantifies business success for the project as a whole. Once we have understanding of the MOS, we'll craft a network of high level achievements to deliver on that MOS. Not all of these HLAs™ will be construction related. Some will capture the customer's business achievements that, in combination with the construction effort, will deliver the MOS™. As an example, say we have a contract to remodel a grocery store. When we understand their MOS™ of increasing sales by 25% we build a high-level achievement network that includes not only the remodeling specs but also the customer's achievement for Deli, Fruits & Vegetable and Pharmacy sales. While we have no accountability for those sales achievements, including them in the plan gives us the information about how our construction effort has to support their operational and marketing plans. We find out what those departments need from us before we start work, not halfway through.

We may track the whole plan or a customer decision-maker may track the whole plan. The important point is we want to manage our construction effort as part of an integrated effort because that improves the odds of success on our part of the effort.

A technique we'll use is to plan from the top down and backwards. That is, we'll secure executive agreement on the end result of the project and then identify the last major achievement and then the one prior to that and so on until we reach the beginning of the project. To continue our grocery store construction example from above, if our Measure of Success is increasing sales by 25%, our last high-level achievement might be a 35% increase of foot traffic through the store. Preceding that we might have an advertising achievement of "35,000 customers in a 4 mile radius of the store receive a flyer on the store's expanded produce, Deli and Pharmacy." Preceding that we might have an achievement of "Pharmacy stock increased to 27,000 items", "Deli space expanded to 9,800 square feet" and "Produce section stocks 450 varieties". Preceding that achievement we might have an achievement where the store management approves the design. While each of those High-level Achievements will have many sub achievements, the high-level network gives us a "big picture" of the entire project, not just the construction effort.

As we work through each phase of the project lifecycle, there is another core technique that we'll use; quantified trade-offs.

QUANTIFIED TRADE-OFFS AND THE “4-CORNERS”

Our measured achievement focus lays the groundwork for managing with quantified trade-offs. The trade-offs we will work with come from the "four corners" of the project we will develop. The 4-Corners are:

- ❑ *Measure of success (MOS™)*
- ❑ *Budget*
- ❑ *Duration*
- ❑ *Risk (probability of success).*

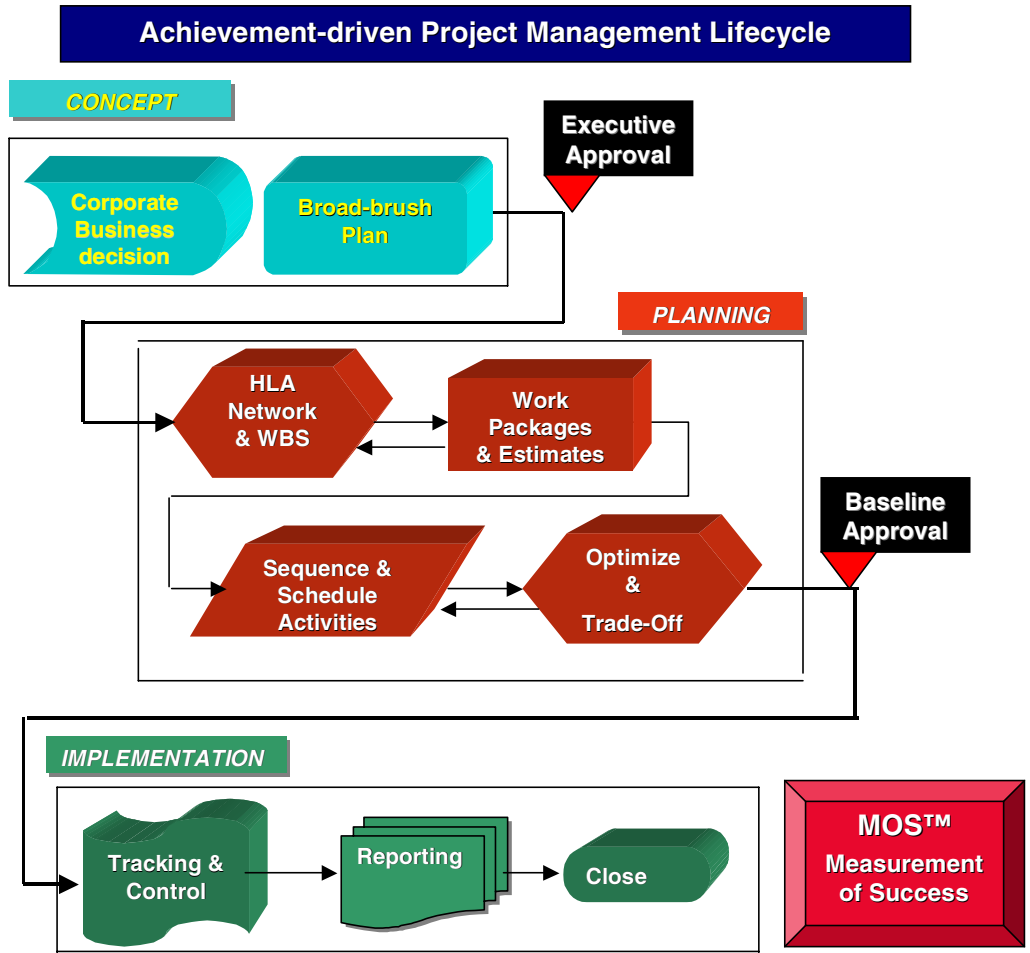
Our intent is to build a project plan where each of these four corners is quantified and we can discuss quantified trade-offs between them. We establish the idea of trade-offs between these four corners early in the project and then we will use it during:

- ❑ *Detailed planning*
- ❑ *The final project approval presentation and*
- ❑ *Every week as we track actual results and deal with changes and problems.*

Rather than try to "fight" with the customer executives about changes to the plan or changes to the requirements, we will present data on these trades-off before they ask. If the executive wishes to shorten the duration of the project, we will calculate the impact on one or more of the other "corners" of the project. We can certainly shorten the duration but the trade-off may increase the cost, reduce what we achieve for the business or lower the probability of success. This trade-off mentality is the key to maintaining a high probability of a successful project by giving us an effective and data based approach to change control. It also allows executives to exercise strategic control over what they are "buying" from the project and that can earn us many benefits in the relationship.

Executives are accustomed to evaluating projects with only one measurable dimension, duration, or at most two, budget & duration. We'll give them four and much better decision-making about trade-offs

Achievement-driven Project Management Lifecycle



Our project management lifecycle diagram summarizes the process we'll be following throughout the remainder of the book.

The project plan flows from the customer's decisions about business objectives and gives us a strategic framework, which we will verify with our Broadbrush planning process. Then we'll detail the plan to build a foundation for their decision-making and our tracking of project progress.

2 – Broadbrush Project Planning

In this chapter, we'll work through the process of strategic project planning, seeking to “frame” our project within the boundaries of measured outcomes in the customer's business. We'll work with the customer to establish and gain approval of a Broadbrush project plan that includes:

- ❑ *An objective measure of project success (MOS™)*
- ❑ *A high-level achievement network (HLA) which lays out in measurable terms our path to the MOS™ and quantifies the boundaries of the project's scope including both customer and E/C achievements*
- ❑ *Project constraints and assumptions*
- ❑ *The project charter including authority structures and accountability relationships*

Having this framework in place before we start work substantially increases the probability of the project being a success in the customer's eyes as well as providing a basis for solid scope control. However, Broadbrush planning is a difficult process, which is why it is skipped on so many projects.

When projects are defined solely as the delivery of specifications, we are unlikely to have a satisfied customer at the end or produce value for their business

WHY WE SKIP STRATEGIC PROJECT PLANNING

Most engineering and construction (E/C) projects start with the assembly of a “grocery list” of specifications and requirements which grows each week during the project because there is no Broadbrush plan to contain the expansion of the project or target its success. We have little ability to define what's in and what's out of the project. Oh, we see long narratives supposedly defining scope and objectives but they rarely contain objectively measurable definitions of success and the measured steps we'll take to reach that end business result. So why do people skip Broadbrush planning? Because it requires us to:

- ❑ *Learn the customer's business*
- ❑ *Speak the customer's language*
- ❑ *Cope with a certain amount of conflict that occurs whenever we force them to make tough decisions.*

No wonder people skip this Broadbrush planning; it's so much easier just to start work. Let's explore several of these challenges in more detail.

First, the language of Broadbrush planning is not technical; it is measured performance improvement in the customer's business and operating functions. We speak their language, not ours, with a focus on measured business achievements. We talk about the "energy cost reduction" and the "customer's traffic patterns" not the capacity of a chiller or a room's capacity. It is difficult to keep the planning discussions at a business achievement level so we can reach agreement on the measured business benefits that will be our target. Many who will be in these discussions will want to get into the delicious technical details, not address what we have to achieve for the business. The PM and our project team members can be their own worst enemy in this regard. We are more comfortable talking about areas of our expertise than the customers' business. But we need to engage executive decision-makers in this process. We quickly lose them if we let the planning sink into the "activity trap" of technical features and specifications.

Second, few PMs enjoy conflict and Broadbrush planning triggers it. Rather than burying disagreements between customer decision-makers, a Broadbrush planning process that focuses on hard-edged and measurable business results brings them to the surface. We're not creating conflict between their decision-makers. Rather, we want to resolve as much of the existing conflict over business results and "what's in the project" as early as possible. No E/C project can meet all of the customer's expectations. The question is, when in the process do we face these issues and start to control the scope. We can defer the existing conflict or smooze it over in the interest of "getting off to a good start," and then face it towards the end when changes are most expensive. Or, we can begin scope control early, which is much better than waiting until the duration and budget start to slip. The latter markedly increases our likelihood of having a satisfied, long-term customer when we are done.

So those are some of the challenges we face in strategic project planning. As a rule of thumb, every hour spent on this process saves 10 hours during the life of the project. We'll use Broadbrush planning to frame our strategic planning, substantially increases the probability of delivering the business results the customer wants within the time frame and budget to which we will commit. With an approved Broadbrush plan, we begin the project with:

- ❑ *The ability to focus our efforts on objectively measurable business results*
- ❑ *Executive agreement on the measured path we will take to reach those end results*
- ❑ *Commitment from the customers to the achievements they must deliver as part of the effort*
- ❑ *Clear authority and accountability relationships across functional lines*
- ❑ *Executive agreement on the processes and decision-making authority for making the inevitable changes.*

THE COPPER INDUSTRIES PROJECT

Let's dive into the case study we will use through the remainder of the book. We'll start with some background information and identify the business factors that will shape the Broadbrush plan. We will be working to understand the customer's business problem, the business benefits analysis, the customer's needs and how the project fits in the customer's overall mission.

OUR PROJECT AT COPPER INDUSTRIES, INC.

Jack O'Connell brushed the snow off the steps of the construction trailer with his well-worn left boot. Looking back at the brown stone building, he saw the surrounding snow-covered acreage reflected in the silver windows. They'd gotten the plant building closed in and heated just before the first snowfall a few months back and finished up last week. Now it was on to the next assignment, a big step up for Jack but he wouldn't be getting away from these New England winters. The assignment with Copper Industries would be 100 miles further north in Vermont.

As he opened the trailer door, the aroma of fresh brewed coffee drove the chill from the morning. Automatic coffee brewers and polar fleece clothing, like the items he'd won in last week's safety drawing, were the only way to survive the winter. While packing his desk contents in a brown box, Jack thought about Copper and the background he had on the company and the plant construction project he'd run for them.

Copper Industries was founded in 1955 by John Copper as a fabricating firm and over the years transformed into a major supplier for a number of industries. In 1985 annual sales reached \$38 million. By 2000 Copper attained a significant market share in a variety of components, annual sales of \$475 million and four plants located around the US. Three years ago the founder's children, Sandy and Terry Copper, took over day-to-day operation of the business when their father suddenly passed away.

Jack knew that he had a high standard to match as John Copper, the founder, had personally managed each of the previous plant projects and they had been instantly successful for the company. Dana Norse, VP of Marketing (VPMK), had told Jack the saga of the founder's project successes during the screening and interviewing process, emphasizing how they had never had an "outsider" from a consulting firm or a new employee manage a project so critical to the company's success.

Later that afternoon, Jack walked into Copper's walnut-paneled boardroom. Dana Norse offered a welcoming handshake and said, "Jack, I'd like you to meet Mark Albright our VP of Operations (VPOP). His people will be running the plant."

Albright, six inches taller than Jack and with flaming red hair said, "I'll be running the project too, after all it is a manufacturing facility not a marketing facility."

From the sour look on Dana's face, Jack wondered what had happened between these two and how it might affect the project.

After an awkward moment of silence, Albright handed Jack a single sheet of paper, saying "Here's what we have so far, it will give you a good idea of where you fit in and what the timeline looks like. We need to be