The 12 Distinctive Attributes of a Good Engineering Project Manager
By Steve Wetterling

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Almost anyone can learn to use the basic functionality of Microsoft Project© and read the Project Management Body of Knowledge© but it takes a lot more than this to become a good Engineering Project Manager:
• Yes, previous experience with similar projects is helpful.
• Yes, soft skills - like how to effectively prepare for and lead project team meetings - are important.
• And, yes, the ability to construct, modify and present an understandable Gantt chart is essential.

But what else makes up a good Engineering Project Manager? The answer to this question, in my personal experience, is set out in 12 distinctive attributes of a really good Engineering Project Manager.

And is it teachable?

Yes, it is teachable within the abilities, motivations and limitations of the individual. This, among other interesting things in my life like managing engineering projects, is what I do.

The 12 Distinctive Attributes of a Good Engineering Project Manager

Synopsis: In addition to knowledge and skill with the methodologies of project management, a good Engineering Project Manager will be more successful leading project teams with the following attributes as part of their every day skill set:

#1 Trustworthy
#2 Able to Speak the Truth to Power
#3 Excellent Communication Skills
#4 Good Working Relationships with Bosses and Customers
#5 Ability to See the Big Picture
#6 Constantly Thinks Ahead Anticipating “What Comes Next”
#7 Actively Manages Project Risk
#8 Develops Realistic Project Plans
#9 Actively Minimizes Complexity
#10 Keeps the “Founding Assumptions” in Mind
#11 Builds up the Project Team and the Team Members
#12 Domain Knowledge and Experience

#1 – Trustworthy
Trustworthy means that your boss and your team members trust what you as the project manager say to be the truth about the project, the people involved and how the plan and flow of events for the project are likely to come to a satisfactory outcome. If people trust you, you can be an effective project manager even when things go wrong. If they don’t, then you and the project that you are supposed to be leading are likely to land in significant difficulty.

#2 – Able to Speak the Truth to Power
This means that you can and will “speak the truth” objectively even when it is painful to deal with shortcomings and even when it contradicts the needs, desires, intentions and beliefs of your management. This is the most basic part of the job as a good Engineering Project Manager. If you don’t or can’t do this, then whatever problems there are will continue to fester despite your otherwise best efforts and the good work of your team members. If you are worried that painful information may lead to halting the project, sometimes that is what should happen for the overall good of the organization. Having the reputation for being trustworthy is a big help with this.

#3 – Excellent Communication Skills
The best project managers I work with have excellent communication skills, both written and verbal, to the point being inspiring leaders. Working on projects with these people, I always want to be like them and be able to do what they are able to do.

#4 – Good Working Relationships with Bosses and Customers
As the project leader you act as the empowered and trusted agent for your boss and his boss to use the organization’s resources and money to accomplish the intended objectives. Your bosses have expectations that you will:
- Do well in this important leadership role
- Use the resources of the company effectively and spend the budget wisely
- Keep them well informed, both informally and through agreed upon formal reporting events like milestone and budget Reviews
- Communicate effectively with the rest of the organization
- Support the sales people in presenting an attractive but accurate message to the intended customers.
All of this requires that you develop and maintain good relationships with your bosses and with the customers.

#5 – Ability to See the Big Picture
How is the project going to affect the rest of the company – manufacturing, facilities, use of components, finance, displacing existing products and the profits that they currently provide, etc. As the project manager for a new product, part of what you do is to present the plans and schedule to the manufacturing organization with enough lead time (weeks, months, even years in some cases) so they can effectively implement a profitable way to manufacture the product. Being the project manager to develop a new product, it is a great help to have previous work experience in a manufacturing role. Being the project manager to bring a new product into manufacturing, it is advantageous to have been in the new product development business.

#6 – Constantly Thinks Ahead Anticipating “What Comes Next”
- A good project manager is constantly looking for opportunities to start tasks on the critical path earlier than scheduled.
- A good project manager pads both time and budget in anticipation of the many things that might and typically do take longer to accomplish than initially planned. Surprises happen and the project plan should allow room for them. In some industries, such as the development of new commercial aircraft, formally setting out pads in the schedule and budget is the expected practice. Part of the project manager’s role in this method is to track and report on how rapidly the schedule and budget pads are being consumed on the way to the next milestone review.
- A good project manager is constantly thinking ahead anticipating negative outcomes and making sure he or she has a recovery plan ready to go. For example: You just failed a critical radio interference (EMI) test delaying an already over-tight schedule. Be ready to walk into your boss’s office to say:
  “Boss, we failed the EMI testing this morning by 6dB. We think we know why and how to fix it. Karen is going over the prototype with the radio sniffer right now. We have another date in the test chamber for Thursday. It will cost another $500 and a couple days of schedule slip that I think that we can make up during the manufacturing introduction phase.”
You sound like you have things are under control and, of course, your boss will concur with your revised plan.
#7 – Actively Manages Project Risk

“Project risk” is everything that could go wrong on a project, including both things you can anticipate and things you can’t. “Risk management” means to actively manage to prevent these things from occurring and to be ready with a recovery plan when they do.

- Informally, this should be part the project Manager’s everyday thought processes.
- Formally, the project team will benefit from an exercise to identify the 100 possible things that could go wrong on their new project.
- There are very structured methods to identify and plan for risk with a project. Large projects in particular should use these. *See Risk Management references at the end of this article.*

Examples of risks that the project manager should be anticipating:

- A task takes longer than planned
- It takes more than one trip to the EMI test chamber for the prototype to pass
- The project team discovers a previously unappreciated dependency between two tasks
- The project fails a milestone review
- A vendor estimated he could make the prototype in 20 days; but after the final prints are delivered, he now says it will take 35 days
- The purchasing department didn’t order the marine grade hydraulic fluid to put into the new ship. The normal lead time from the Chevron special products depot is two weeks but the ship must launch by next Wednesday.

Your job as the project manager is to anticipate risks and have a recovery plan ready to go when they do happen, because they will.

Examples of project risks you can’t anticipate:

- Your lead customer is suddenly purchased by a competitor and now doesn’t want your new product
- The chief system architect for your project has an accident with serious head injuries and is unavailable for an unknown duration
- The cargo container with your first 850 production units for Best Buy falls off the ship in a storm and is lost
- A previously unheard of Jihadist organization hijacks and flies airplanes into the World Trade Center Twin Towers
- The venture capitalist funding your project is arrested and charged with fraudulently helping himself to the investors’ funds.

Your job as the project manager is to understand that these kinds of things happen in this world and to quickly create a competent recovery plan.

#8 – Develops Realistic Project Plans

The #1 source of project risk in my experience comes from setting out an incomplete and overly optimistic project plan:

- The objectives are too ambitious, and at the same time are neither inclusive or specific enough – both of which will have to be added in later
- Schedules are typically two to five times under-estimated
- Budgets are typically two to 20 times under-estimated
- There are no or insufficient time and budget pads in anticipation of surprises.

Project plans with these problems are typically the outcome of an incomplete or poorly executed project planning cycle.

Or you may have found yourself in an organization where the culture is: “The President knows it will take more time and money to complete a new product and he just allows for it. It’s always been done that way.” When the culture of the organization delivers mixed messages, my recommendation is to try to lead by example, which becomes active training about how to develop realistic project plans that are then executed on-time and on-budget as the normal course of events.
#9 - Actively Minimizes Complexity
The #2 source of project risk in my experience is not appreciating the complexity of what is being undertaken. It takes intelligent thought and time to drill down through all the “knowns” to the “unknowns”, to do the work to understand how to change the unknowns to knowns and then to see how this new information impacts the project plan. Understanding, planning, scheduling and budgeting complex projects generally takes longer than you think it will. And greater complexity makes project risk worse – exponentially. The good Engineering Project Manager actively evaluates project complexity, acts to reduce complexity and works to mitigate the consequences resulting from complexity. Note that changes/additions to product features during the course of development almost always bring new complexities to a project. Your action is to make sure that the revised work plan, schedule and budget to support the new product features will succeed.

#10 – Keeps the “Founding Assumptions” in Mind
Assumptions are part of the foundation of all project plans. For example:

- The continued viability and operation of your business unit
- How many of the new product will be sold
- The profitability of the new product
- Competitors’ actions
- What can be accomplished with the chosen technologies
- Intentions to show the new product at an important trade show
- Availability of production volumes by a specific date
- An implementation schedule that is in alignment with an important external event such as a legislative appropriations cycle or a seasonally important sales period like the Thanksgiving & Christmas retail sales season.
- A date beyond which schedule slippages are likely to make the new product unviable.

You generally put the “Founding Assumptions” into the originating Charter and Scope & Limits statements. As part of each milestone review, it is essential to include a review of the founding assumptions upon which the original project plans were based so as to judge the continued viability of the expected outcomes. In the same manner as the everyday active management of “what comes next”, project risk and project complexity, the good Engineering Project Manager compares how the on-going flow of events is either confirming or contradicting the founding assumptions and takes action as indicated when there is a significant disconnect.

#11 – Builds up the Project Team and the Team Members
In the project manager role, you are leading small and sometimes large groups of mostly peers. You are advised to:

- Create routines that team members can organize their time and efforts around
- Lead by good example – no one likes a hypocrite nor follows one willingly
- Do not criticize – the long term damage will always be greater than whatever short term gain you think you might be achieving
- Do offer positive direction and coaching. If there is a need for a change in behavior, set it out kindly as a simple actionable request; for example “Ed, when you discover a potential performance problem during your prototype testing, please review this in a private meeting with me and the engineering managers before the next project team meeting. If you think it will help, let’s set up a regular 9:00 Tuesday meeting for this with just the five of us to review and understand the issues before the 10:30 regular team meeting that everyone attends.”
- Build up the project team and the team members with praise and rewards for accomplishments small and large
- Provide skill development opportunities for team members, ultimately aiming to replace yourself in the current project leader role so that you can go onto lead bigger projects for your company
- Be able to evaluate Team Members abilities and performance objectively so that you can have realistic expectations for what can be accomplished, and to be able to intervene with training, coaching or ultimately change of assignment if the accomplishments consistently fall short.
#12 – Domain Knowledge and Experience

It is not an absolute requirement for training in engineering, science, mathematics or computer science to be a good Engineering Project Manager. However formal technical training and/or years of specific on-the-job experience is going to be a huge advantage during the planning and execution phases. It will be particularly helpful when directing the necessary problem solving efforts that will come up. Here are some real world examples:

- It helps to know about concrete, steel, weight bearing walls, foundations, excavations and construction costs when you have to go into the SeaTac Airport Authority board meeting a month after the 9/11 tragedies to tell them the $3 Billion terminal upgrade project that was just completed will have to be extensively redone to meet the new transportation security requirements.
- When the library sort & search function of the new digital audio archiving system can’t find the songs of a hot Czech rock band, you can understand the software engineer’s explanation that the currently implemented UTF-8 Unicode character set is incomplete, and can furthermore accept his forecast that it will be relatively easy to fix.
- From your years of experience with the AWACS flyable Command & Control systems, you know exactly how the operator station really functions. When the validation test cases for your company’s training software is being developed and reviewed, you know what makes sense and what does not.
- Dealing with a Class D switching amplifier that is running too hot, you can observe that the design engineer’s substitution of a 10,000 pF filter capacitor for the 1000 pF value listed in the reference design increased the displacement current by a factor of 10 and the dissipated power [heat] by a factor of 100.
- You are starting up a new project with VISA, Inc., to implement new credit card security measures. As part of the planning cycle, you submit proposed encryption alternatives A thru D to a mathematician for his review. His report states that for all four alternatives, the Hamming distance is too small to withstand the code breaking computing power likely to be readily available during the 10 years of intended usage of the new security measures. You can engage in a constructive conversation about how the proposals might be improved.
- As a simple case, when an engineer during a design review says that there is a problem, you have an internal basis to judge, without asking, whether this problem is likely to be of greater or lesser significance: “Is this a show-stopper or just an item to add to the Bug Fix List?”

This level of technical engagement was beyond the capabilities of the retired Marine Corp special operations gunner, the promoted assembly line supervisor and the motivated young man with a communications degree & a Project Management Professional (PMP) certificate, all of whom carried the job title and had some success as a project manager. These intelligent hard working people just reached their limits pretty quickly managing projects in a strongly technical environment.

**In conclusion:**

No Engineering Project Manager is an ace with all 12 attributes every day and for all time. I want you to be encouraged by what is presented above and in my courses to develop expertise in both the methodologies of project management and the leadership skills that will help a project team effectively execute a project plan they believe in with high quality outcomes on-time and on-budget. These skills are teachable and with practice can become part of what you do in the role of Engineering Project Manager. See the Auxilium, Inc. website for the course offerings and schedule – [www.auxilium-inc.com](http://www.auxilium-inc.com).
References on formal practices of Project Risk Management:

   
   Purchasable from the ISO web store:
   

2. **Practice Standard for Project Risk Management**, by the Project Management Institute
   
   Purchasable from the Project Management Institute webstore:
   

3. A Commercial Risk Assessment and Management tool:
   
   See the Oracle Primavera white paper “A Standardized Approach to Risk Management Improves Project Outcomes”,
   

4. Note that the provision of the “Builders Bond” in the heavy construction and ship building industries is a long standing practice in those industries to manage project risk. The insurance companies who back these bonds have industry specific practices to evaluate, forecast and price for project risks.

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*Steve Wetterling – June 2012.*