How to Improve Student Project Management Skills

By Mike Ambrose, P.E.

Introduction

Most engineering jobs require some form of project management from managing your own time to get a particular task completed to managing a multi-million dollar international design team. Most undergraduate curricula do not include a basic course on the subject. There is not much time in a four year degree to squeeze in more subjects. However, project management skills are important to most successful engineering careers.

Undergraduate programs do include many group projects where students are thrown together to sink or swim. These projects provide an excellent opportunity that will benefit you for many years. Obviously the project is part of your grade and grades are part of how you will be judged for future opportunities. Additionally, they can be used to develop or hone human interaction ("people") skills. These skills are critical for nearly every job. Project management skills are important for successful completion of this project and future projects. Finally, the grades and skills can be parlayed into a job by reference on a resume or discussion in a job interview.

Project Management Process

The project management process is fairly simple:

1. Designate a project leader
2. Define expectations
3. Develop a schedule/work plan
4. Assign people to individual tasks
5. Develop a budget
6. Assess progress
7. Adjust the plan
8. Repeat steps 6 and 7 until complete.

Each step is discussed below.

Select a Leader

The project leader is critical to success. There should be only one leader. Multiple leaders cause unnecessary strife or missed assignments. The leader needs to take ownership of the project and lead the team to a successful finish. A leader has to develop his or her own leadership style. Everyone is a little different and will lead in a different way.

Many students have a number of courses together. Consequently, some of the same teams form again and again. The project leader role should rotate so the same person is

not the leader each time. This will avoid burnout and give others an opportunity for experience. A project leadership role is great experience for use in your resume or job interviews.

Define Expectations

The expectations for a project are defined by four items:

1. Scope of the project
2. Definition of quality
3. Critical characteristics
4. What is success?

If you don't know where you are going, you won't know when you get there. This step sets limits on how big the project will be and standards everyone on the project team will use to evaluate progress and the end product of an individual task or the entire project.

The product or outcome of a specific task could be anything from an analysis, calculation, report, computer program, drawing, design, to a part or a complex machine. The quality of each product is measured differently based on the expected deliverable.

Quality can be somewhat ambiguous, but the team should try to define the desired quality of the end product. Many organizations like ASME, Institute of Electrical and Electronics Engineers (IEEE), and the American National Standards Institute (ANSI) have established standards that can be used as common measuring sticks. The instructor can provide you with insight into the expected quality. Previous projects that were well done can be used as an example.

The team should also discuss who will assess the quality of individual products and how will conflicts be resolved. Several methods include an individual checker (or reviewer), a group review, or a third party (i.e., a party not involved in the project) review.

Develop a Schedule/Work Plan

Obviously, schedules are important because you have fixed dates when the project begins and when the end product is due. Developing the schedule starts with these fixed dates. Next, the project should be broken down into individual tasks. This is called the work breakdown structure or WBS. It is not a "To Do" list of every possible thing that needs to be done in the project. Rather it is the assignments project team members will be accountable for delivering. As a result, developing an effective WBS requires a great deal of thinking, not just writing down everything you can think of for the team to do.

The time to complete each task should be estimated. Also, the interdependencies of tasks must be identified. For example, you may need to prepare a surface before you paint or spray primer before the final coats.

Remember people are generally optimists and will often underestimate the time required for a task. You should think about contingencies if one task is not complete on schedule.

If possible, include some float or free time between tasks to allow for unplanned delays. Identify milestones when team members will review progress with the project leader or team.

There are many types of schedules. Three common schedules that are simple to use are a schedule of end dates, bar chart, or Gantt chart.

A schedule of end dates is just as it sounds. It provides a list of tasks with the date when each task will be complete as follows:

Kickoff meeting	11/01
Develop scope	11/08
Select paint color	11/19
Select material	11/15
Paint block	11/24

This type of schedule is very simple and easy to create, but it does not tell anything about when the tasks will begin, how long they will take to finish, or if and how they are interdependent.

A bar chart (see example below) can be created on a spreadsheet and provides more information. The bar chart indicates task durations and start/end dates, but does not necessarily indicate the task relationships.

The Gantt chart (see example below) was created by Henry Laurence Gantt (1861-1919) in the second decade of the 20th century. Gantt was a mechanical engineer, management consultant, and industry advisor. The Henry Laurence Gantt Medal awarded by ASME is for distinguished achievement in management and for service to the community.

Gantt charts are used as a visual tool to show scheduled and actual progress of projects and are accepted as a commonplace project management tool today. A Gantt chart lays out the order in which tasks need to be carried out. Gantt charts help manage the dependencies between tasks. You can immediately see what should have been achieved at any point in time. Gantt charts also allow you to see how remedial action may bring the project back on course.

Assign People to Individual Tasks

This is a critical part of the project planning process. To avoid any confusion, always assign only one person responsible for each task. Multiple people may be working on a task, but only one person is responsible for completing that task. Match the skills and abilities of individual team members to the requirements of each task. You don't want to under whelm or overwhelm any particular team member.

Always give the most critical task to the best team members. Typically, there are one or maybe two tasks that are critical to the success of your project. If that task is late or completed poorly, the project's success can be jeopardized. You should assign the

person or persons that can get that task completed within the allotted time and provide the best results.

As stated above, think about fallback strategies or contingencies should something not go as planned. Periodically review progress and reassign tasks as needed to complete the schedule on time. Students have other demands on their time and can get quickly overloaded.

Develop a Budget

You may be given a set amount of money or you may have to use your own funds, but any project plan needs to address the budget. Since you are students, your time does not cost money. Projects in the corporate world must account for the cost of labor. Some items to consider are

- Hardware
- Software
- Equipment or instruments
- Consumables (e.g., paper, toner, pens)
- Food supplies (pizza, drinks, etc.)

Assuming you are typical college students, you won't have a lot of capital with which to work. The bottom line is to "beg, borrow, or steal" as much as you can.

Constraints

The project plan sets the budget, schedule and quality expected for a given scope of work. These criteria are what is known as the triple constraint.

The budget, schedule and quality are all tied together. The triple constraint is represented by an equilateral triangle. Changes in one criteria will impact the others. For example, when a project falls behind, project managers will often assign more people or resources to catch up. This typically adds to the cost and may impact quality. Keep the triple constraint in mind as a project proceeds.

Assess Progress

Assessing the project's progress is like steering a ship. You need to see how far you've gone and where you are to determine where you should go next to match your intended course.

This step is where you really need people skills. Many times people just don't follow through on their commitments. Some people will attempt to mislead when they know they are behind thinking they can catch up later. Most are the eternal optimists believing they will get the job done no matter what has been done to date or how much time is required to finish. Some may have a different definition from you of the expectations of the task. A good method to check on the status of individual tasks is to request an intermediate work product as proof of the stated progress. This will help alleviate any misunderstandings early in the process.

The project leader should check progress often. Generally, this is done in the form of a progress meeting. The purpose of progress meetings is to communicate the project status and key decisions, identify any barriers to progress (time, knowledge, skills, money, etc.), make course corrections, and set near term goals. The content of the meeting should include each person's report on status of their tasks, discussion of any key decisions that must be made, communication of any changes since the last meeting, overall progress review, and review of action items that resulted from previous meetings. The project leader should keep track of reports and action items and update task schedules accordingly.

Meetings

Meetings are important to any successful project. There are essential steps required to have an effective meeting. Everyone has limited time. There may be alternatives like email, phone calls, or one-on-one conversations that can be used instead of another meeting.

The person leading the meeting (typically the project leader) should prepare for the meeting by defining the objectives and desired outcomes. The leader then identifies the topics for discussion and develops an agenda. The agenda for the meeting should be distributed to the attendees before the meeting, so they have time to prepare.

Everyone attending the meeting needs to prepare. They should know the purpose and agenda. Each person should realize his or her role and assemble the necessary data. One key point is to arrive on time. Also, the meeting should start on time. As stated above, everyone has limited time and they would like to use it wisely.

The person leading the meeting should ensure everyone is allowed the time to be heard. The participants should be concise and to the point and participate in a constructive manner. Use the agenda to stay on track. The leader should summarize key points or ask for agreement to ensure everyone understands the point of the discussion. Close out the meeting by reviewing key decisions and next steps or action items.

Meeting minutes or notes are an important part of documenting and communicating key decisions and actions. A note taker should be designated before the meeting begins. The notes should include who attended, the issues discussed, key decisions, and action items (including who is responsible, when the item will be completed, and what will be accomplished).

Adjust the Plan

As stated above, the plan should have intermediate milestones to measure actual progress against your expectations. Contingencies should be considered as necessary. Don't wish for faster progress. Bad news does not improve with age. Take action as necessary. The key to completing a project is communication.

Keep reviewing the progress through progress meetings and adjusting the plan until the project is complete.

Motivational Tips

Motivating a project team is not an easy task. Typically, engineering students can't offer monetary incentives like bonuses, trips, or other promotions. This is not atypical of project management in the corporate world. Many times project teams are comprised of members from different departments and the project leader will not have many tools to motivate staff other than the project itself. Some people are not motivated by monetary rewards anyway.

The team leader should lead by example. The autocratic style is not a good model to follow in the long run. Project team members are generally willing to work harder for someone that is also working hard.

Ask for input from the team members on assignments and schedule. Team members will be more accepting of tasks and schedules if they have some input. Many team members are motivated more by the content of their assigned tasks rather than any other factor. But, remember the project leader should make the final decision regarding assigning tasks and determining the schedule.

Peer pressure can be a good motivational tool. Most people do not want to come to a meeting of their peers and admit they cannot complete a task or are behind schedule. Track specific tasks and action items and review those in the progress meetings.

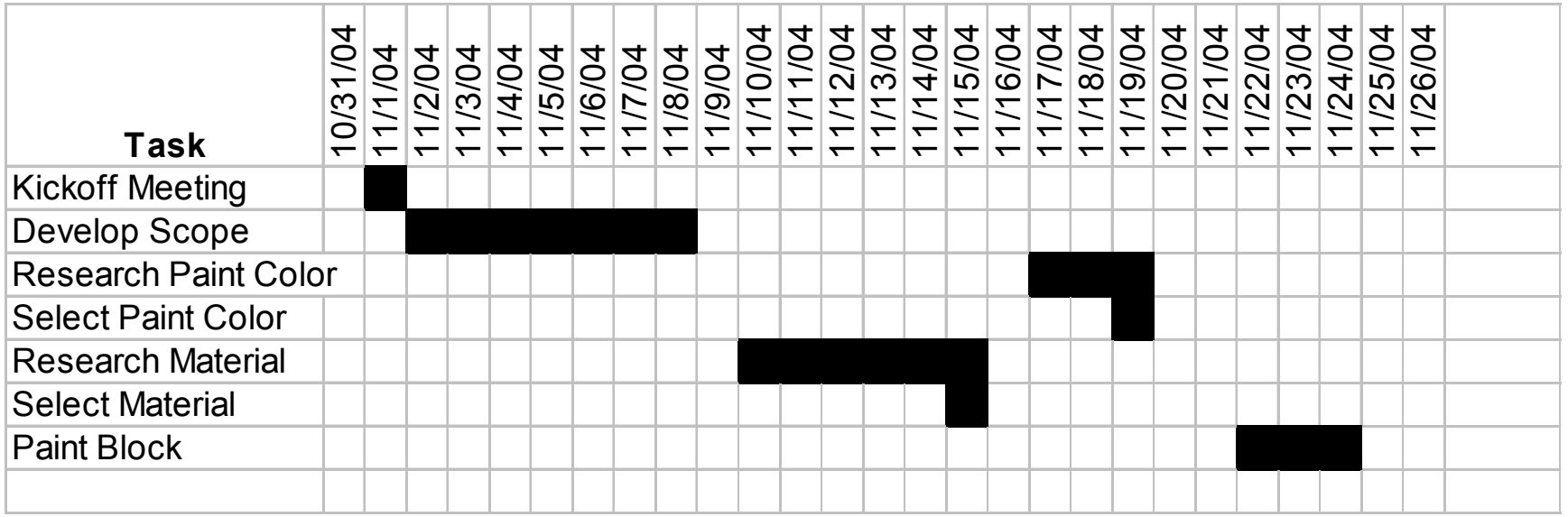
Social events like a team dinner can be used to garner support and generate excitement about a project.

Summary

Project management skills are important skills to have. The key points to remember are to identify the project leader first, assign each task to one person only, include flexibility in the project plan, set intermediate milestones, and hold regular progress meetings. As

Ronald Reagan once said when speaking about foreign leaders, ‘trust, but verify’. The same holds true for the project team.

Example Bar Chart Schedule



Example Gantt Chart