Project Management Overview

Project = an endeavor to create a unique product or service

- Finite beginning & end
- Unlike an assembly line to make chain saws, which is an ongoing process

Inputs & outputs

- Inputs = resources: time & materials
- Time => complete tasks. Keyword: Schedule
- Materials => money. Keyword: Budget
- Output = deliverables: prototype, thesis, new house, …

Successful project: Scope, Schedule and Spend to complete work:
Deliver result on time, within budget

- Scope the project: Decide what we will do, as accurately as possible
- Move steadily along the Schedule timeline
    - Project divided into tasks: quanta of work
    - Schedule progress is measured in completion of tasks: Milestones
- Spend the Budget at the appropriate rate
    - Remove barriers to task completion
    - The Marching Army Effect
    - People getting paid, but unable to advance schedule; waiting for something

Why do projects fail?

- They run out of Schedule or Budget (time or money)
- "The death of a thousand cuts."
    - Not usually a single catastrophic event ("the rocket blew up")
    - Usually a sequence of small delays that add up, bleed project to death
    - Senior Design: Schedule is the big problem

Project management elements

- Planning: Establish goals, tasks, budget
- Execution: Keep everything moving
- Project management tools
    - Graphs & tables: Gantt charts, organization charts, work breakdown structure, financial statements & balances
    - Software tools: Microsoft Project

Engineering and R&D challenge: Manage uncertainty

- Not like building a house, where everything is fairly predictable
- "Design is learning"

Planning: Task scheduling

Example #1: one person, build a bookshelf

- Tasks
    1. Specify problem – interact w/customer
    2. Research options
    3. Design: Make decisions
    4. Order materials & wait for delivery
    5. Build
        - Cut
        - Assemble
        - Finish
    6. Deliver
    7. Get paid!
- Tasks are sequential
    - Sequence matters: some tasks depend on others
    - Can estimate Schedule and Budget for each step
        - Don't forget to include delivery time for materials!
    - Build a time line with milestones
        - Specify – 2 wks
        - Research – 1 wk
        - Design – 1 wk
        - Order materials: this is a milestone
        - Wait for delivery – 3 wks
        - Build – 3 wks
        - Deliver – this is another milestone
    - Milestones are check points
        - Easily to identify when they are done
        - Tracking progress – if date is passed and milestone not met, project is late: Behind Schedule!

Example #2: Team, develop a computer-controlled electromechanical device

- New elements: Teamwork and Parallelism
    - Requires coordination & communication
- Team: made up of people with different skills
    - Define tasks as before
    - Assign people to tasks
        - Now a dependency matrix: Gantt chart

Work Breakdown Structure (WBS):

- Break project into manageable bits
- Hierarchical tree listing all tasks needed to complete project
    - Each level except the lowest breaks into two or more entries
    - If you can't estimate complexity & time at a level, break it down unto subtasks
    - Must be complete: have all the tasks in the project
    - Enough detail to enable personnel to understand & complete tasks
    - Time estimates must add up to the next level up
- Sometimes number tasks

    - Task 1
        - Subtasks 1.1, 1.2
            - Sub-subtasks 1.1.1, etc.
- Gantt Chart
    - Visual display of tasks on a timeline
    - Include dependencies: sequence in which tasks must be done
    - Milestones: test points to track progress
    - Can make by hand, or with Microsoft Project or Excel

Execution & Tracking: Project team management

- Team stages
  - Orientation (**Forming**) – polite, tentative, excited
  - Dissatisfaction (**Storming**) – conflict over resources, agendas, personality differences
  - Resolution (**Norming**) – work out structure & expectations
  - Production (**Performing**) – cooperate, get the job done
  - Termination (**Adjourning**) – celebrate!
- Communication: can make or break a project!
  - Between the team and the customer & between team members
    - Working documents
    - Specifications & Requirements
  - Design documentation: conceptual design, status reports
  - Meetings
    - Synchronous
    - Maximum bandwidth
    - Must be disciplined
  - Email: Engineers live by it!
    - Asynchronous
    - Persistent record
    - Follow protocol (handout)
  - Blackboard model: project web site, Wikis
  - Communications should be concise but complete
    - Miscommunication costs time, money, morale
    - Keep it professional!

Time management

- Dealing with uncertainty
  - Tendency: compensate by increasing schedule
  - Try to eliminate unknowns early in the game
- Causes of delay
  - Time lost due to poor communications
  - Competing for resources
    - Machine shop or ECE Electronics shop
  - Delivery time on parts
  - Can't make a decision
    - Customer vacillating, unsure
    - Provocative Communication (Flagpole): "this is what we will do unless you say otherwise"
    - Forces a decision
  - You can't decide
    - Get over it: learn to make executive decisions
      - It's a critical survival skill
    - Acquiring executive judgment takes experience
      - Executive neglect: sometimes problems go away or fix themselves if you ignore them
  - ***Be a pest***

        - It's easy to assign something to someone else, then forget it: "it's their problem now"
        - If it's your task, then it's your problem
        - *Be polite but persistent in getting updates, locating and removing barriers*
- **Tracking progress**
- **Periodic (weekly) meetings**
    - ***Assess progress with respect to schedule milestones***
    - ***Take corrective actions where necessary***
    - ***At each meeting, for each individual***
        - What was your assignment/goals for this week?
        - Is the goal met?
            - *Yes: celebrate!*
            - *No: Define corrective action*
        - Assign tasks & goals for each team member for next week

Resources

- **Wikipedia: Search for "Project management" and follow the links**
- **A Short Course in Project Management: http://office.microsoft.com/enus/project/HA102354821033.aspx**