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Mechanical Analysis and Design
ME 2104

Lecture 3

Project management

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Plan for this lecture

- Project management overview
- Project management tools
  - » Work breakdown structures
  - » Team calendars
  - » Gantt charts
  - » Budgets

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Managing Design
(Academic Project Management)

- Design is an activity that can consume significant time and resources
- This lecture outlines various techniques that allow a team to manage and control a design project
- The *3Ss* of project management:
  - » Scope
    - – To know the goals and to accomplish them
  - » Spending
    - – To complete the project within the specified budget
  - » Scheduling
    - – To finish the project “on time”

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Project Management Approach

- Managing the design process consists of four functions:
  - » Planning
    - – Define scope, schedule and spending (the *3Ss*)
  - » Organizing
    - – Determine who is responsible for each project task
  - » Leading - Motivate team by showing that
    1) tasks are fair
    2) division of work is fair and
    3) level of work produces satisfactory progress toward goals
  - » Controlling
    - – Relies on a sound plan to measure progress and take corrective actions

Tools that can be applied in these phases are explained

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Project Management Tools

- Work breakdown structures (planning, organizing)
  - » Determines scope of activities
  - » Hierarchical representation (like a family tree) of all tasks
  - » Work is "broken down" into pieces small enough to estimate resources (£, number of persons) and time required
- Team calendar (planning)
  - » Shows time available to the *team*
  - » Highlights deadlines
- Gantt chart (planning, organizing)
  - » Horizontal bar graph mapping design activities (and their duration) against a timeline
  - » Shows parties responsible for activities

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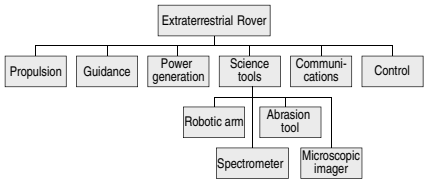
PM Tools: What must be done to FINISH the job

Work Breakdown Structures (WBS)

- WBS is considered the *most* important management tool for design projects.
- It decomposes overall task into smaller, more manageable subtasks.

As a simple example, consider a spacecraft design:

Mars Exploration Rover (MER)



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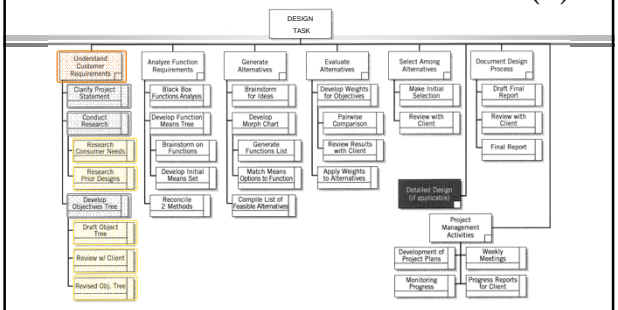
PM Tools: What must be done to FINISH the job

Work Breakdown Structures (1)



- Observation 1:
  Each item that you take to a lower level should be *always* broken into *two or more subtasks*

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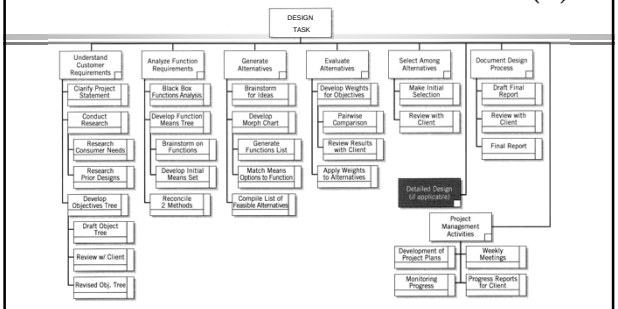
PM Tools: What must be done to FINISH the job

Work Breakdown Structures (2)



- Observation 2:
  Break down an activity until you can determine
  > *how long it will take* and > *who will do it*

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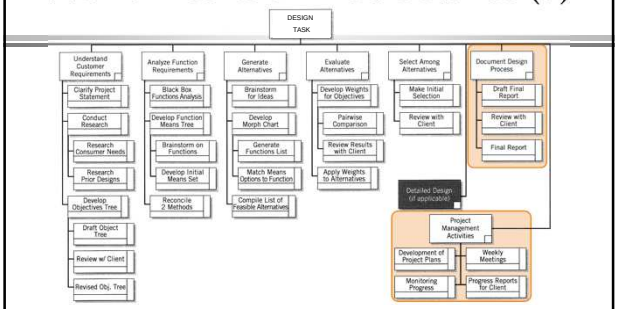
PM Tools: What must be done to FINISH the job

Work Breakdown Structures (3)



- Observation 3: WBS should be *complete* in the sense that any activity that consumes resources or time is included
- Observation 4: Any part of the hierarchy of tasks should *add up*

Team Calendars

- A mapping of deadlines (given to you) onto a traditional calendar
- Also include team - generated deadlines for tasks in the WBS
  - » Becomes an extension of the team working agreement
  - » Include recurring or routine activities such as team meetings

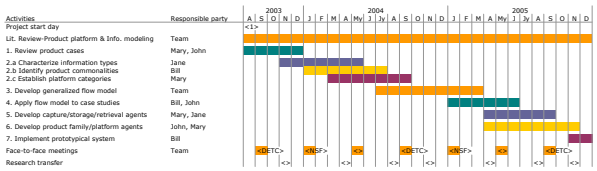
Team Calendars

- Points to keep in mind:
  - » Team calendar should be reviewed at each meeting
  - » Times on calendar should be consistent with WBS

Gantt Charts

- The Gantt chart is named after a well known industrial engineer, Henry Laurence Gantt
- During World War I (1910s), he studied manufacturing processes and labor utilization to improve the productivity of munitions factories
- A Gantt chart is an easy-to-use, valuable Project Management tool
- It shows, in one table:
  - » Tasks to be completed
  - » Persons responsible
  - » Start, duration, and end times/dates
  - » Activity precedence (what has to be done first, in what order)

Gantt Chart Example



- For scheduling, it is critical to understand the *precedence relationships* between tasks
  - » Sequential tasks - Task 1 must be finished before Task 3 can begin
  - » Parallel tasks - Tasks 3 and 4 can be undertaken simultaneously (or in parallel)

Budget: Show Me the Money

- Design project budgets consist of:
  - » Research expenses
  - » Materials for prototypes
  - » Materials for your "final" product (really, it is still a prototype)
  - » Value of design team time
- For the upcoming project, you will be allowed only £30
  - » This £30 covers the first three categories of the budget
  - » For this project, you will be judged (to a certain degree) on the cost of your "final" product - not to exceed £30
  - » The total cost of the project will exceed that amount if you include the value of your time

Value of Design Team Time

- A simple algorithm to estimate value of design team time
  - » $Cost_{team} = M_{overhead} * Cost_{direct}$
  - » $M_{overhead}$ is a multiplier that covers fringe benefits, supervision, profit and facilities costs to the organization
  - » $Cost_{direct}$ is the money/pay that you, the designer, would see in a paycheck
  - » Typical values: $M_{overhead} = 2 – 4$, $Cost_{direct} = £15 – 50$ /hr
- Even at a minimal wage (£5/hr) for a design team of five for ten hours a week for ten weeks, the cost is £5000-10,000

Conclusion on Budgets

- Make initial estimates of your budget for
  - » Research expenses
  - » Materials for prototypes
  - » Materials for your “final” product
- For value of team time, keep records of hours spent on the project throughout the semester
  - » The bottom line on the value of design team time:

Time is Money!

Einstein discovers that time is actually money.