Design Teams and Project Management

- Team dynamics (Ch. 15)
  Stages of working as a team
  Conflicts
  Leadership and membership

- Managing a project (Ch. 16)
  Work breakdown structures (WBS)
  Team calendar
  Gantt chart – not part of chapter in textbook

- Ethics in design (Ch. 17)

Managing a Design Project (Ch. 16)

The three Ss': Scope, Schedule and Spending (Sec. 16.1)

- Scope sets the limits of what the team must accomplish, in particular in terms of deliverables;
- Schedule sets the time frame within which the project must be completed.
- Spending sets the available resources and how they may be applied to the project.

- Sample questions arising when clarifying the three Ss':

<u>Scope:</u>

- What is required, a conceptual design, a detailed deign, or something in between?
- Is a working prototype required?
- Is it sufficient to demonstrate key functions?
- Is a complete set of engineering drawings needed?
- To whom does the design team report?

<u>Schedule:</u>

- When are the deliverables due?
- Are there other due dates such as monthly progress reports?

<u>Spending</u>:

- How many people will be on the team? How many will work on the project full time? Part time?
- What materials and supplies are available to the team?
- Is there a dedicated space for the team to work in?
- Are there dedicated shop technicians?

Tools for Managing the Scope of a Project (Sec. 16.2)

- Team Charters (Sec. 16.2.1) and work Breakdown Structures (WBS) (Sec. 16.22)
- Team Charter is a written document outlining project requirements, including objectives, deliverables, time frames (milestones), and resources limits and other relevant information.
- Fig. 16.2

This charter documents key information regarding a project to be conducted by students at HarveyMuddCollege (HMC) on behalf of a student at the Danbury School. The faculty advisor will be Professor Dym; the liaisons for Danbury will be Mssrs. H and J. The project manager/team leader will be selected at the outset of the project by and from among the members of the student team.

The ream agrees to abide by all restrictions and regulations of Danbury School, when on site, to place the safety of the client as its highest priority, and to work in accord with HMC's Honor Code.

Goals

The project is assigned as part of HMC's introductory design course, and the students understand that they are expected to work to accomplish HMC's goals for the course, Danbury's goals fo the project, and the needs of a particular user.

The goals of the E4 courses are to:

1. *Develop and understanding and experience of the conceptual design process;*
2. *Give the students experience in team dynamics; and*
3. *Enable students to learn to manage small design projects*

The goals of the Danbury school are to:

1. *Improve Jessica's learning environment and quality of life; and*
2. *Increase public awareness about the conditions faced by students like Jessica.*

Deliverables

The following deliverables will be completed by the last Friday before final exam week:

1. *A prototype arm stabilization device which has been designed, built and tested for Jessica's use;*
2. *Final design documentation for Danbury School and for the E4 teaching team; and*
3. *A public presentation of the team's design process and results.*

Resource Limits

The team is expected to work an average of 10 hours per week per team member. HMC will provide not more than $125 to the team for the purpose of purchasing supplies and materials for the project.

Other Restrictions and Information

The team will place the safety of the user above all other aspects in their design activity. The team will hold weekly meetings with their faculty advisor, and will meet regularly with the sponsors at Danbury.

Figure 16.2

- Tools for Managing the Scope are Team Charters (Sec. 16.2.1) and Work Breakdown Structures (WBS) (Sec. 16.2.2)
- Work Breakdown Structure is a hierarchical representation of all the tasks that must be performed in order to complete the project.
- Figs 16.3 and 16.4
- The idea behind WBS is to decompose complex projects into small enough units such that individuals can be assigned to the units, and the time and resources to complete the units can be established.

Preliminary Work

a) Examine problem statement
b) Research
c) Visit Danbury School
    i) Talk with Jessica
    ii) Take measurements
    iii) Hands-on examination of what device must do
    iv) Talk with teachers and physical therapist

2) Zoning in
    a) Finalize problem statement
    b) Create full list of objectives and constraints
    c) Rank objectives
    d) Create metrics
    e) Create objectives tree and determine functions
    f) Communicate with client on objective, constrains, and functions

3) Brainstorming for Design Alternatives
    a) Use morph char to create combinations of alternatives
    b) Create sketches of design alternatives
    c) Conceptual testing of alternatives

4) Picking a Design
    a) Use metrics and objective tree
    b) Compare the design alternatives against metrics
    c) Communicate with client
    d) Preliminary testing on selected design

5) Building a Prototype
    a) Activities prior to building

b) Gather materials
c) Determine sources and tools needed to build
d) Divide work
    i) Building prototype
    ii) Assemble parts
    iii) Test prototype
    iv) Document test results

6) Final report

7) Presentations to client and class

8) Overarching Work
    a) Organize meetings
    b) Organize building days

Figure 16.4

- *Tools for Managing the Schedule of a Project (Sec. 16.3)*

- Team Calendar (Sec. 16.3) and Gantt Chart

- Team Calendar is a mapping of time commitments onto a conventional desk/wall calendar, including externally imposed deadlines (by clients, project managers, and so on) and internal time commitments/deadlines (such as team meetings, etc.)

- Fig. 16.5

- Example calendar for design team:
    - Friday 2nd 5:00 PM "Prototype Built"
    - Tuesday 6th 7:00-8:15 PM "Team Meeting"
    - Friday 9th 11:00 AM "Proof of Concept Data"
    - Monday 12th 11:00 AM "Rough Outline Due"
    - Tuesday 13th 7:00-8:15 PM "Team Meeting"
    - Friday 16th 5:00 PM "Topic Stance Outline Due"
    - Monday 19th 11:00 AM "Presentation Outline Due"
    - Tuesday 20th 7:00-8:15 PM "Team Meeting"
    - Wednesday 21st 11:00 AM "Sliders Due"
    - Friday 23rd 5:00 PM "Draft Final Report Due"
    - Monday 26th 10:00-11:00 AM "Present Results"
    - Tuesday 27th 7:00-8:15 PM "Team Meeting"
    - Friday 30th 5:00 PM "Final Report due"

Figure 16.5 – Team calendar for student design project.

- Tools for Managing the schedule of a project are Team Calendar (Sec. 16.3) and Gantt Chart

- Gantt Chart is a graphical representation of the duration of tasks against the progression of time.

- Gantt charts are useful tools for planning, scheduling and monitoring projects.

- A Gantt chart is a bar chart for project management.

- There is a variety of Gantt charts.

- Only the basic Gantt charts are considered here.

- Notes on Gantt charts
    - Timeline on top
    - Split time into 3 or 4 days per increment
    - Tasks on vertical axis
    - Tasks need to be sequenced (tasks further down the row don't' start before the previous row)
    - 'Gathering Results' – typically done by one person
    - Add an 'Action By' column to show who is responsible for what task
    - Triangle pointing up for start of task, triangle pointing down for end of task
        - "Action By' shows who is responsible for the task
        - An up triangle indicated start date, a down tringle indicated end date
    - Length of line between triangles needs to be accurate (put numbers next to triangles)
    - Expected to have on Gantt chart:
        - Task or sub-task or sub-sub-task (taken from WBS);
        - Start date and end date of the task or sub-task or sub-sub-task;
        - Individual(s) responsible for the task or sub-task or sub-sub-task;
        - Time scale: week or 4+3 days

- *Managing the Spending of a Project (Sec. 16.4)*

- Budget, see Fig. 16.6

- *Monitoring and Controlling a Project (Sec. 16.5)*

- Gantt Chart can be used for monitoring purpose

- *Managing the end of a Project (Sec. 16.6)*

- Documents check-off (to ensure ALL deliverables are delivered)
- Post-project audit (formal or informal; lessons learnt; future improvements)

Ethics in Design (Ch. 17)

- Ch. 17 has 6 sections, covering why engineering ethics, a variety of codes of ethics, cases of doing the right thing (Sec. 17.4, Citicorp building in NYC) and otherwise (Sec. 17.1, NASA's Challenger)

- Key aspects of professionalism and ethics

- Professionalism: the skill or competence, judgement and conduct worthy of belonging to a profession.

  Specialized technical knowledge
  Maintaining standards
  Life-long learning
  Public service

- Ethics: a system of moral principles; a person's or a business's or organization's sense of right and wrong.
- Personal ethics: the morals and values that define how a person is as a person.
- Professional ethics: the morals and values that define how a person behaves in a professional setting.
- Divided loyalty: engineers have obligations to many stakeholders whose interests do not completely align.
- Codes of ethics provide guides as to how to deal with conflicting obligations engineers face.

- Codes of ethics (by Engineers Canada):

  Protection of the Public and the Environment
  Competence and Knowledge
  Faithful Agents of Client and Employers
  Fairness and Integrity in the Workplace
  Professional Accountability and Leadership

- Code of ethics (by National Society of Professional Engineers):

  1- Holding paramount, the safety, health, and welfare of the public
  2- Perform services only in areas of competence
  3- Issue public statements only in an objective and truthful manner
  4- Act for each employer or client as faithful agents or trustees.
  5- Avoid deceptive acts.
  6- Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honour, reputation, and usefulness of the profession.

- Reading assignments (for next week)
    - 1.4
    - Ch. 15, Ch. 16, Ch. 17
        - (Ch. 16.1, Ch. 16.2, Ch. 16.6)