Teams, Teamwork and Planning

W.H. Mason

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Product Design Teams

Classical Options:

- the *Skunk Works* approach has proven to be the best for small projects using experienced team members

    - small, expert, team members with lots of responsibility

- the Matrix System has been successful in large projects

- the Matrix System is not always best: too many bosses

Modern Approach:
- Include "the Customer" on the design team
    - example: the Boeing 777
- Highly integrated product/process development teams (IPPT)

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How will you do it?

- Efficient team interaction
- Team *decisions*: what do we need to do?
  - **decision making is a key aspect of design**
- Individual Analysis using engineering methods, including computer tools
- Meet to put results together, make a decision, decide how to act on it, and go do it

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from the Wall Street Journal, Dec. 13, 1992:

**Campuses Fall Behind
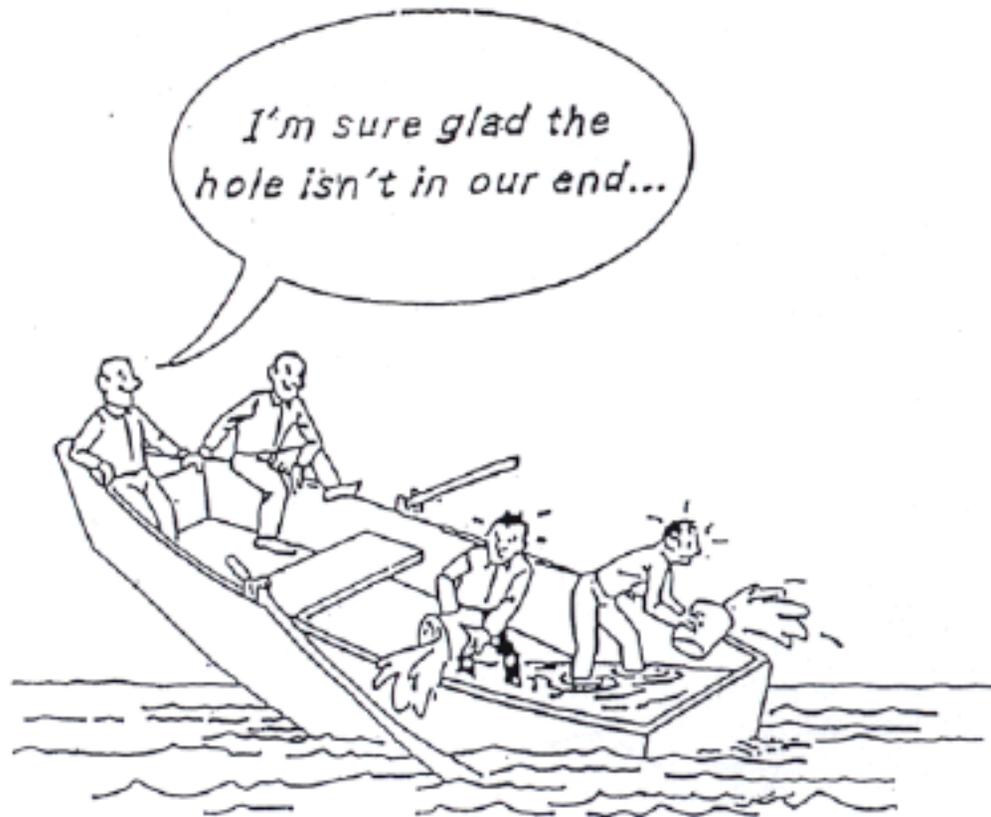In Teaching Teamwork**

Colleges and universities: Get on the Team.

The Corporate Design Foundation, Boston, says U.S. higher education is failing to keep up with business's need for professionals who know how to team up with other disciplines. More and more companies are using multidisciplinary groups to develop better products faster, says the foundation.

But "only a handful" of campus programs combine engineering, business, design and other disciplines, adds the group. Carnegie Mellon and a joint effort of the Massachusetts Institute of Technology and the Rhode Island School of Design are the only true programs, says Peter Lawrence, chairman of the foundation.

Businessmen agree on the need. Jim Stryker, manager of product development at Ingersoll-Rand says: "No one is teaching it." But Glenn Gardner, Chrysler's general manager, large-car engineering, sees the schools starting to catch on. He says, "Last year we hired three engineers from MIT, and they understood teamwork perfectly."

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From Boeing

Systems Thinking

Whether we like it or not, we are all in this together.

What is Teamwork?

- It *is not* everyone getting together to work on the same homework problem

- **It *is*:**

    - establishing the question that needs to answered

    - each team member taking responsibility for a particular task and doing the work

    - putting the results of each task together at a group meeting and establishing: Did we answer the question?

    - If so, what's next? If not, how do we recast the question?

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How a Productive Team Works

Indicators

- Open communications
- Few mistakes
- Low levels of conflict
- Cooperation
- Responsibility
- Few Complaints

Assessing, analyzing, and taking corrective action

Causes

- Clear and accepted *roles*
- Clear and agreed-upon *goals*
- Positive *relationships*
- Well-defined *processes* and *procedures*
- Effective *leadership*

Results

- Capitalizing on opportunities
- Correct decisions
- Deadlines met
- Decreased costs
- Effective use of time
- Innovative and effective problem solving

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Source: Varney, *Building Productive Teams*

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Effective Teams

1. Atmosphere - informal, relaxed, comfortable

2. All members participate in discussion

3. Objective of the team is well understood/accepted

4. Members listen to each other

5. There is disagreement, but group accepts it

6. Most decisions reached by a kind of consensus

7. Criticism is frequent, frank, constructive; not personal

8. Members feel free to express feelings as well as ideas

9. Action: assignments are clear and accepted

10. Leader does not dominate

11. Group evaluates operation, resolves problems

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Source: Parker, *Team Players and Teamwork*

Ineffective Teams

1. Atmosphere of indifference/boredom or tension/antagonism

2. A few team members dominate

3. An observer has a hard time understanding team objectives

4. Team members do not listen, discussion jumps around

5. Disagreement not dealt with effectively

6. Actions taken prematurely, before real issues resolved

7. Action: unclear—what is to be done and who does it?

8. Leadership clear, whether weak or strong

9. Criticism appears embarrassing and tension-producing

10. Personal feelings are hidden

11. Group does not examine its performance/process

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Source: Parker, *Team Players and Teamwork*

We're all different: personalities/roles

Effective teams contain a mix of personalities:

One categorization:

- **Contributor**: task oriented, enjoys providing team with good information, does homework, pushes excellence

- **Collaborator**: goal-directed, sees team mission/goals, but willing to help outside his/her defined role, share limelight with other team members, seen as a "big-picture" person

- **Communicator**: process-oriented, effective listener and facilitator; consensus builder, resolves conflicts, seen as a "people person"

- **Challenger:** questions goals and methods, willing to disagree, encourages team to take well-conceived risks.

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Source: Parker, *Team Players and Teamwork*

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People and Styles: Important to team performance

- **1st** dimension**: personal problem solving style:**
  - reflective, listens, thinks, *then* speaks: an **introvert**
  - energy from interactions with others, speaks, *then* thinks: **extrovert**
  - **extrovert s: 75% Americans, 48% of engineers**
- **2nd** dimension**: preference for facts or possibilities**
  - **75% of Americans fact oriented, 66% of top execs, 34% of engineers**
- **3rd** dimension**: objective or subjective decision making**
  - **51% of Americans objective, 68% of engineers, 95% of top execs**
- **4th** dimension**: decisive or flexible decision making**
  - **50% of Americans decisive, 64% of engineers, 88% of top execs**

from **David G. Ulman,** *The Mechanical Design Process*

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Five Stages of Team Development

Stage	Major Processes	Characteristics
1. Forming (orientation)	Exchange of information; increased interdependency; task exploration; identification of commonalities	Tentative interactions; polite discourse; concern over ambiguity; self-discourse
2. Storming (conflict)	Disagreement over procedures; expression of dissatisfaction; emotional responses; resistance	Criticism of ideas; poor attendance; hostility; polarization and coalition forming
3. Norming (cohesion)	Growth of cohesiveness and unity; establishment of roles, standards, and relationships	Agreement on procedures; reduction in role ambiguity; increaded "we-feeling"
4. Performing (performance)	Goal achievement; high task orientation; emphasis on performance and production	Decision making; problem solving; mutual cooperation
5. Adjourning (dissolution)	Termination of roles; completion of tasks; reduction of dependency	Disintegration and withdraw; increased independence and emotionality; regret

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common, but this chart from Don Evans

Boeing Code of Cooperation for Teams

1. EVERY member is responsible for the team's progress and success.

2. Attend all team meetings and be on time.

3. Carry out assignments on schedule.

4. Listen to and show respect for the views of other members.

5. Criticize ideas, not persons.

6. Use and expect constructive feedback.

7. Resolve conflicts constructively.

8. Always strive for win-win situations.

9. Pay attention — avoid disruptive behavior.

10. Ask questions when you do not understand

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adapted from the Boeing Commercial Airplane Group
via Don Evans, Arizona State Univ.

Mason's Suggested Group Approach

- Ask the questions:

  - set realistic goals, use milestones to meet goals

  - establish the parametric & pro/con trade studies needed

  - do the work

  - as a team, interpret the results

- A Caution:

  - ***Don't do anything unless you understand how it contributes to your final product***

  - An outline of the team goal (*e.g.*, mid term revue, final presentation and report) is crucial to efficient work

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A Good Team Member

- is a strong advocate for his/her area

- is willing to accept changes to improve total design

- is responsible

    - accepts and meets reasonable goals

    - provides data/info when a team member needs it

    - data is accurate and presented understandably

    - uses bulletin board to accomplish data transfer

    - good communicator: lets people know what's going on

The Team Notebook:

• Each team must have their notebook ready for inspection

• The notebook must contain:

  - Statement of Long Term Goals (presentation, report, *etc*.)
  - Sequence of intermediate milestones required to achieve goal
  - Explicit definition of decisions to be made at milestones
  - Criteria to use in making the decision at each milestone
  - Minutes of team meetings, (1 page!) with
      > actions taken/decisions made
      > team member task list/due date: initialed by members

• Faculty advisors will review this document at each team meeting

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To minimize team problems

- 1st Mtg: Get to know each other, talk about commitment to team and personal goals: Do you just want to pass? Do you want to win? *Don't kid yourself or the team!*

- Make the most of your meeting time:
  - use agendas
  - have a facilitator
  - take minutes
  - draft next agenda
  - evaluate the meeting
  - use the "100 mile rule"

- Maintain communications

Ref: Peter R. Scholtes, *The Team Handbook*

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An Elaboration on Effective Meetings

especially important for international team telecons

- Use an *Agenda* to define the purpose of the meeting
  - What's to be decided?
  - Distribute *before* the meeting
- Cover one item at a time
  - try to establish time budget beforehand
- Stick to a prescribed time, don't drag it out!
- Summarize decisions and actions to be taken
- Evaluate your team process: is it working?

further details, *The TEAM Memory Jogger*, pp. 71-86

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Planning

- Gantt Charts (Bar Charts) are used
  - Provides an overview
- To Use:
  - Define the tasks
  - Define milestones - *that can be measured*
    - » 90% complete **is not** a milestone
- Software is available to help
  - Microsoft Project is available in the design lab

> **If you don't take time to plan, you are planning to waste time.**

Creative Problem Solving,
Edward and Monika Lumsdaine

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Project Management

- A Project:
  - A set of non-routine tasks leading to a goal
  - A distinct start and finish date
  - A limited set of resources that may be used on more than one project

- Why Plan a Project?
  - Communicate what you are going to do
  - Get support from team members
  - Gain approval from management
  - Show the customer how you intend to deliver the product
  - Prove the need for additional resources and manage work loads
  - Determine cash flow needs
  - Keep a record of what happened compared to the original plan
    - » Basis for future estimates

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From *Managing Projects with Microsoft Project*,
by Gwen Lowery

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The Steps in Planing

- Set the project goals

- List the tasks

- Estimate how long each will take

- Decide on the sequence of tasks and the relationship between them

- Assign people, equipment and costs for the tasks

- Track the progress *using milestones*, and manage the project
  - Project management software makes this possible, *MS Project* in this class

From *Managing Projects with Microsoft Project*, by Gwen Lowery

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Real Examples from Mason's Desktop

- Lockheed Martin/VT Truss-Braced Wing Study for NASA Langley

- Flight Control Requirements for High Speed Transport Aircraft for NASA Langley

- Landing Gear Study for NASA Ames

- Truss-Braced Wing Flight Demonstrator plan for NASA Dryden

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Example from LMAS/VT Study for NASA LaRC

SOW		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
		1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
3.0	TASKS									
3.1	Baseline Configurations									
3.2	Advanced Concept Development									
3.3	Optimization and Sizing									
3.3.1	Multidiciplinary Optimization									
3.3.2	Configuration Sizing									
3.3.3	Preliminary Structural Analysis									
3.3.4	Stability & Control Estimation									
3.3.5	Preliminary Aerodynamic Analysis									
3.4	Second Iteration (Removed)									
3.5	Geometry Development									
3.6	Preliminary Cost Analysis									
3.7	Identication of Enabling Technologies									
4.0	DELIVERABLES									
4.1	Formal Technical Report									
4.2	Kick-Off Review									
4.3	Monthly Technical Progress Report									
4.4	Midterm Review									
4.5	Final Oral Presentation									
	MILE STONES									

Kick-Off Meeting   Midterm Review   Final Presentation   Contractor Report

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Flight Control Req'ts for High Speed Aircraft

Activities	1994	1995	1996
	D J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D J

Activities:

- Start Project
- 1 - Modeling Params
- 2 - Inner Loop Specs
- 3 - Spec Validation (optional)
- 4 - Control Req
- 5 - Control Software
- 6 - Crit Aero Params
- 7 - Aero Uncertainty
- 8 - Aero Software
- 9 - Design Studies — XB-70 — HSCT 1 — HSCT 2
- End Project

Deliverable Items:

- Informal Status Report
- Formal Status Report
- Grant Renewal App
- Oral Report
- AGCB "One Pager"
- Preliminary Software
- Final Rep/Rev/Soft

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Landing Gear Study Plan for NASA Ames

Tasks	Phase 1			12 mos	Phase 2			24 mos
	3	6	9		15	18	21	
1. Survey	� bars							
2. *cg* estimation and validation								
3. Landing. gear weight estimation								
4. Gear concept selection								
5. Vehicle clearence								
6. Wing planform/ ldg. gear design integration								
7. Demonstration of design optimization								
Deliverables • monthly email report • Tech briefing #1 • Phase 1 final report • Tech briefing #2 • Final Technical Report	• • • • • •	• • • • • •	• • • • • •	✳ ✳	• • • • • •		• • • • •	✳ ◆

Example of a Program Plan Leading to Flight

Phase 2 Schedule

	Quarters After Go-Ahead												
	Year 1				Year 2				Year 3				Year 4	
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd

1.0 UAV Test Activities
- 1.1 Wind Tunnel Model Design & Fab
- 1.2 High Speed Test, LaRC 16FTT
- 1.3 Low Speed Test, LaRC 14x22
- 1.4 Strut Mechanism Test Rig Design & Fab
- 1.5 Strut Mechanism Test, LaRC B1148 Lab

2.0 UAV Detail Design and Analysis
- 2.1 Aerodynamics
- 2.2 Stability & Control
- 2.3 Structural Analysis
- 2.4 Propulsion
- 2.5 Sub-Systems Design

3.0 UAV Flight Control System
- 3.1 Design Flight Control System
- 3.2 Fabricate Flight Control System
- 3.3 Pre-Flight Test

4.0 UAV Fabrication

5.0 UAV Flight Test Activities
- 5.1 Pre-Flight Tests
- 5.2 Flight Tests

6.0 Reviews/Reports
- 6.1 Reviews
- 6.2 Interim Reports
- 6.3 Final Report

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Tips for Taking Control of Your Time

- List everything you need to do today - in order of priority.
- Make time for important things, not just urgent ones.
- Write your goals. Then write the steps to your goals.
- Set a starting time as well as a deadline for all projects.
- Slice up big projects into bite-size pieces
- If you run out of steam on one project, switch to another
- Say no to new projects when you're already overloaded
- Trim low-payoff activities from your schedule
- For each paper that crosses your desk: act on it, file it, or toss it

From a day-Timer system ad

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Worth the time: Stephen R. Covey
The 7 Habits of Highly Effective People

The Time Management Matrix

	Urgent	Not Urgent
Important	**I** **Activities** Crises Pressing Problems Deadline-driven projects	**II** **Activities** Prevention Relationship building Recognizing new opportunities Planning, recreation
Not Important	**III** **Activities** Interruptions, some calls Some mail, reports, meetings Proximate, pressing matters Popular activities	**IV** **Activities** Trivia, busy work Some mail, phone calls Time wasters Pleasant activities

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Results

- **Quadrant I:**
  - Stress
  - Burnout
  - Crises management
  - Always putting out fires
- **Quadrant III:**
  - Short-term focus
  - Crisis management
  - See goals and plans as worthless
  - Fell victimized, out of control
  - Shallow or broken relationships
- **Quadrant IV:**
  - Total irresponsibility
  - Fired from jobs
  - Dependent on others or institutions for basics

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Results

- **Quadrant II:**
  - Vision, perspective
  - Balance
  - Discipline
  - Control
  - Few crises

Covey's book is essentially about moving to Quadrant II

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To Conclude

Good Cheap Sources (1-800-643-4316, www.goalqpc.com)

The Memory Jogger II ($7.95,)

The TEAM Memory Jogger ($7.95)

Project Management Memory Jogger ($7.95)

The Creativity Tools Memory Jogger ($7.95)

Two Good Not-so-cheap Sources

The TEAM Handbook

The Memory Jogger Plus+

(featuring the 7 management and planning tools)

One last tip: stay focused

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