

Formula SAE Team Management: An Annual Management Plan

By: Team #4
Tobiah Halter
Ray McCormack
Cesar Castilla
Dana VanMechelen
Nutthapong Mitranond

Agenda

- Introduction - What Is Formula SAE?
- Project Manager
- Organizational Structure
- Planning
- Scheduling
- Budget & Cost
- The Nature of Conflict
- Allocation of Resources
- Monitoring & Control
- Project Auditing & Termination
- Conclusion
- Discussion and Questions

Introduction

- Society of Automotive Engineers (SAE)
 - Collegiate Design Series
- Scale Size Formula-1 Style Race Car
- Target Market
 - Weekend Racer
- Project Strengths
 - Innovation, education, dedication
- Project Weaknesses
 - Organization, Scheduling, Resource Allocation
 - Lack of Managerial Skills

Background

- Program developed to give real world experience to engineering students
- Since 1981 has spread to all disciplines including engineering, marketing, finance, and fabrication
- Grown 20 fold in past ten years and is world wide
- Perhaps the most respected academic experience among automotive industry

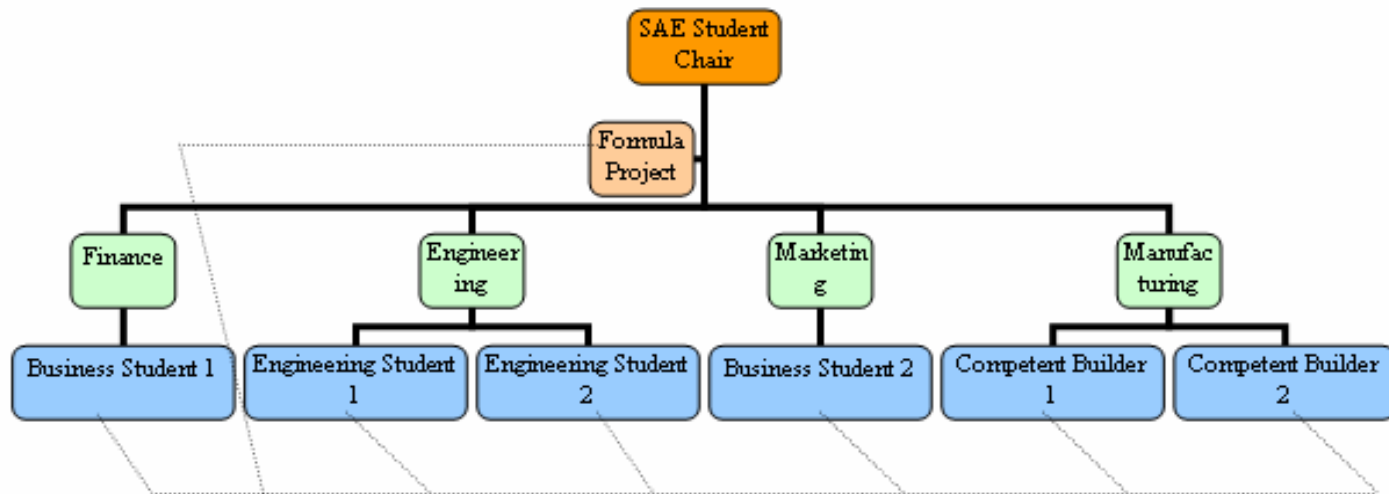
Project Manager

- Typically self-appointed or informally delegated
- Should be chosen based on experience with the project and project management capabilities
- Communication and Conflict Resolution important
- Select a PM early in the Initiation stage
- PM should not be the technical expert in one area, rather, should be dedicated to ensuring the success of the project

Organizational Structure

- Functional, Pure Project, or Matrix?
- Applying Industry Organization to an Academic Project
- University as Parent Company
 - Individual Departments as functional divisions
- Academic Matrix Structure

Hierarchy



Project Planning Coordination

- Project leader
- Participant list / functions & extended
- Objectives defined -> mission, goals, strategy
- Launch / kick off
- Scope / performance/ schedule / budget
- Revisit the plan -> project plan

Project Planning Integration

- Major objectives are as follows:
 - Performance -> how will it be measured and monitored, what actions can be taken
 - Effectiveness -> how will the project plan impact the project
 - Cost -> what cost does the project plan create over the project its self ?

Project Planning Organizing

- What is to be done, by whom, and when
- List of activities, break into groups of 20 or less
- Action plans
- Tree diagram
- Memo creation for the organization

Project Planning Work Breakdown

- Creation of Work Breakdown structures
- Documentation / assumptions of the WBS's
- Review and update the WBS's with interested parties

Project Planning Interface & Integration

- Use of TREND
- Recognize key interfaces between functions & efforts
- Milestones & phases; are they well thought out ?
- Processes for monitoring and coordination

Project Scheduling Creation

- Look at previous years
- List assumptions
- Milestones & deliverables
- Tool Use; PERT & GANTTs
- Measures & controls, weekly PMT with updates
- Overlap between phases; information hand off & rework time

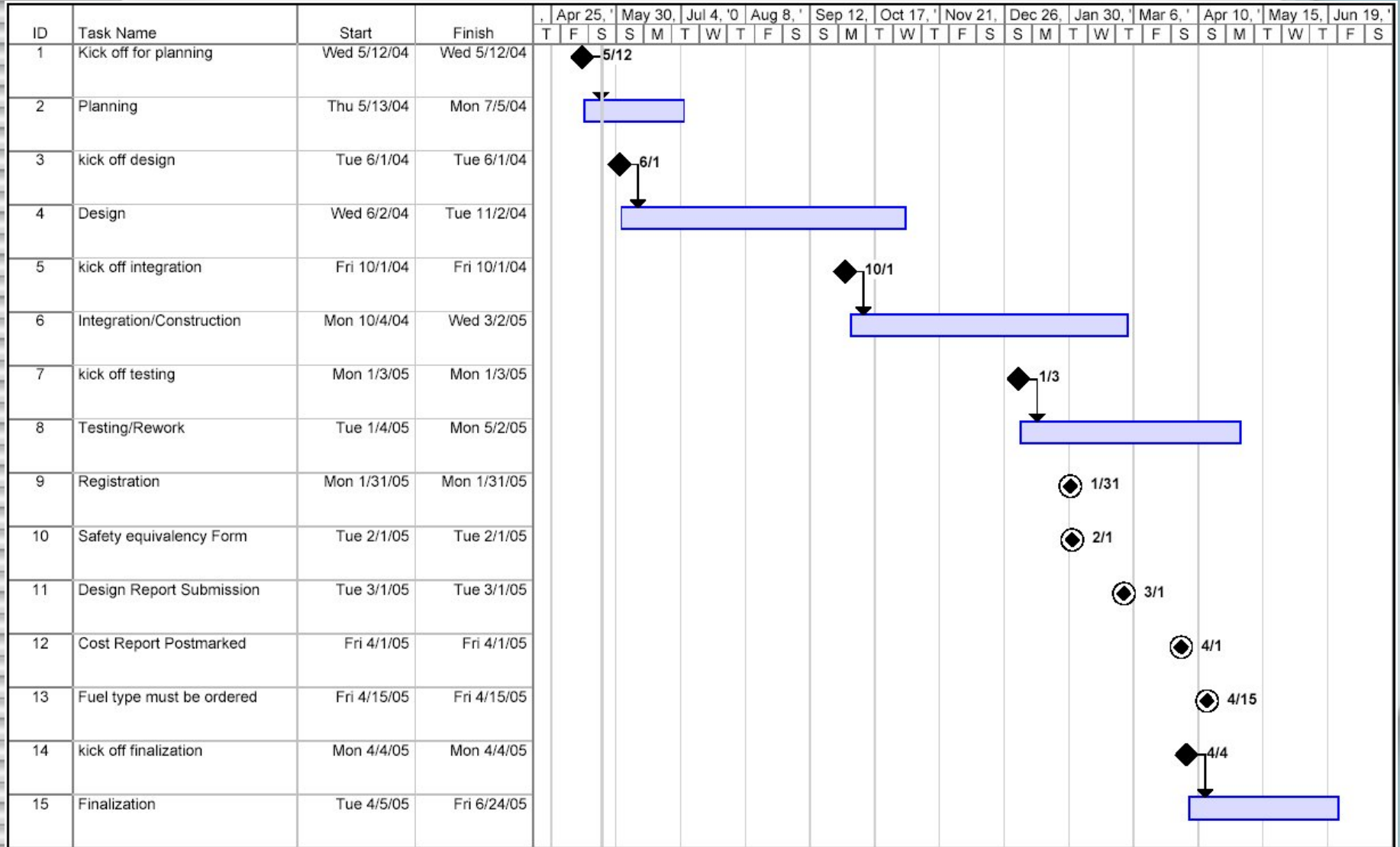
Project Scheduling Resource Allocation

- Look at previous years
- Assigned according to function & schedule
- Consideration of skills vs function
- Staggering of resources => load balancing

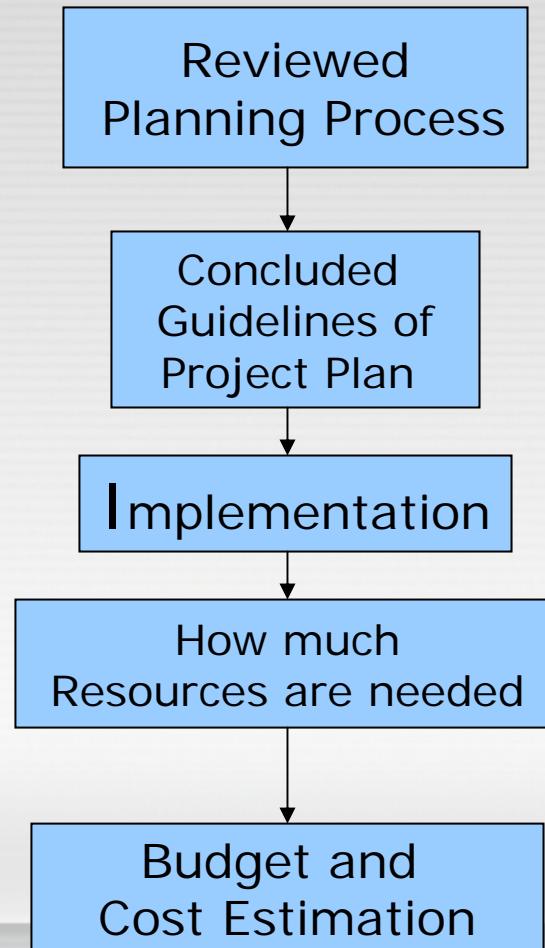
Project Scheduling Risk Analysis

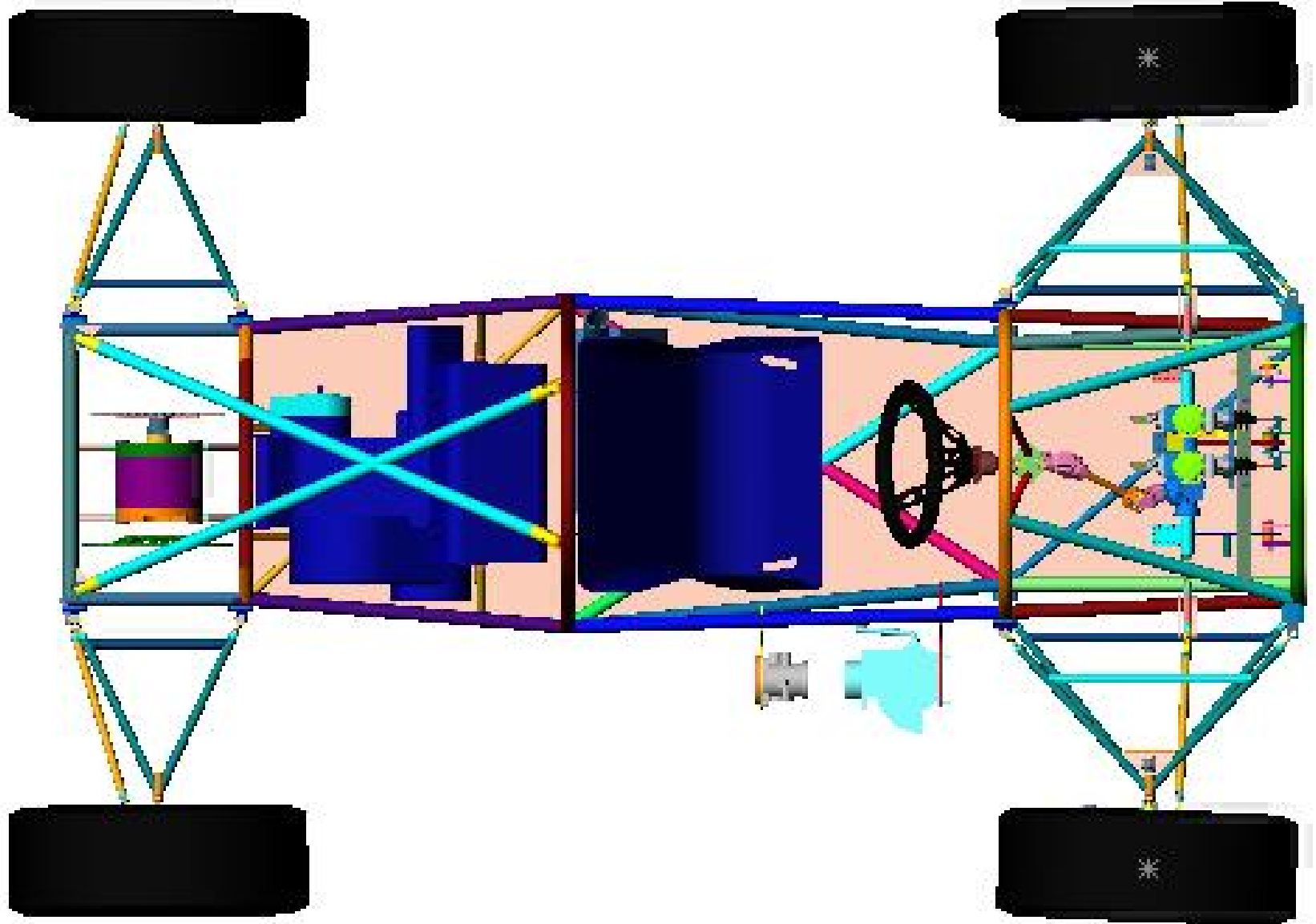
- Look at previous years
- Interviews of previous members
- Milestones & deliverables
- Critical path analysis
- Buffers where needed
- Clear information on most & least risk; present to stakeholders

Project Scheduling GANTT



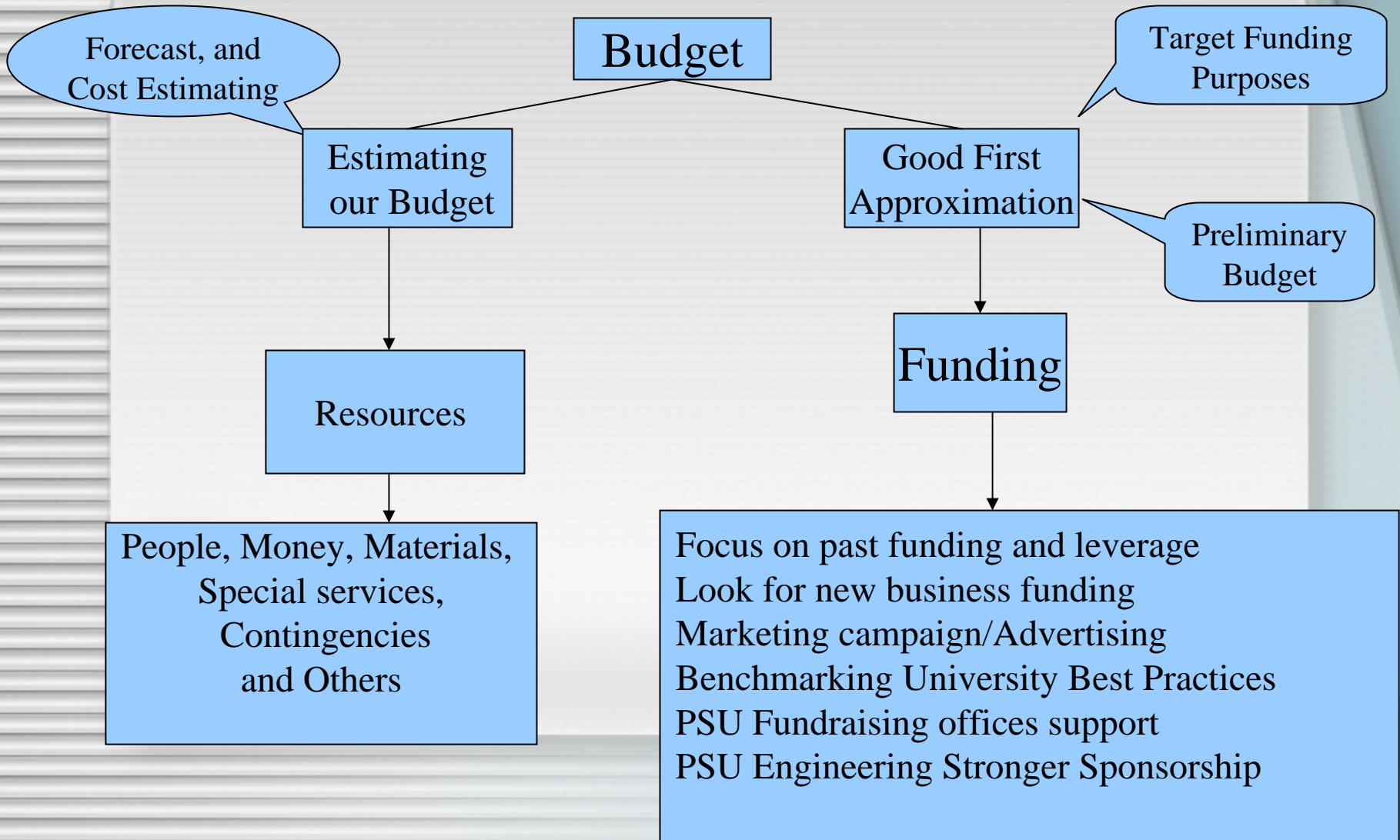
Project Budgeting and Cost Estimating



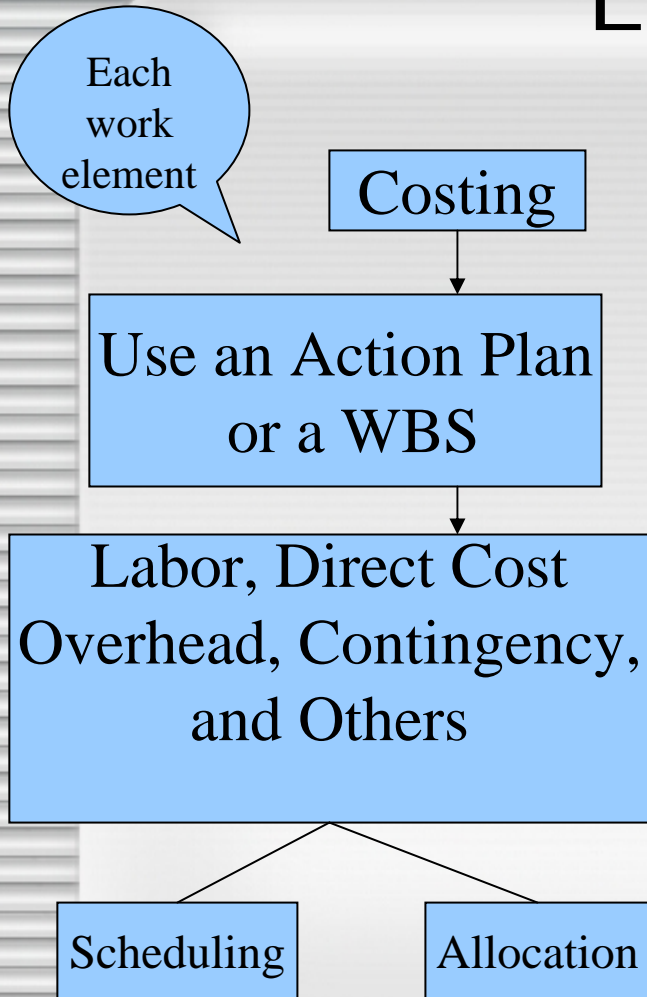


SCALE TENTH	DRAWN BY JEREMIAH ROGERS	MATERIAL N/A	RHS# NONE	JOB NUMBER 119	REV
PORTLAND STATE UNIVERSITY PORTLAND, OREGON		PART NAME <div style="text-align: center; font-size: 2em;">TOP VIEW</div>			

Project Budgeting and Cost Estimating



Project Budgeting and Cost Estimating



Total Costs	
Costs	Amount \$
Material	
Labor	
General & Administrative	
Fixed Overhead	
Total Factory Cost	
Testing	
Scrap	
Freight	
Total Cost	

2003 Expense Report

<i>Chassis</i>	
Tubing	\$ 400.00

<i>Engine Compartment</i>	
Engine	\$ 2,000.00

Seat \$ 150.00

Intake \$ 200.00

Cockpit Controls	\$ 300.00
Mounting Brackets	\$ 100.00
Miscellaneous	\$ 500.00
Total Chassis	\$ 1,450.00

Exhaust	\$ 350.00
Turbo System	\$ 1,500.00
Miscellaneous	\$ 500.00
Total Engine Compartment	\$ 4,550.00

<i>Drive Train</i>	
Differential	\$ 375.00
U- Joints	\$ 200.00
Sprockets	\$ 200.00
Shafts	\$ 175.00
Chain	\$ 50.00
Miscellaneous	\$ 500.00
Total Drive Train	\$ 1,500.00

2003 Expense Report

<i>Chassis</i>	
Total Chassis	\$ 1,450.00
Total Drive Train	\$ 1,500.00
Total Brake System	\$ 2,000.00
Total Body/Aerodynamics	\$ 1,150.00
Total Fabrication Equip.	\$ 1,320.00

<i>Total Project Cost</i>	\$ 23,670.00
----------------------------------	--------------

<i>Engine Compartment</i>	
Total Engine Compartment	\$ 4,550.00
<i>Suspension/Steering</i>	
Total Suspension/Steering	\$ 5,250.00
<i>Safety Equipment</i>	
Total Safety Equipment	\$ 1,450.00
<i>Travel</i>	
Total Travel	\$ 5,000.00

Area or Commodity	Part Name	Description / Model # or Part #	Purch. or Manuf.	Qty	What is paid	Retail cost each	Unit of measure	Suppliers name	Total retail cost	Sub-totals
Brake System	Brake fluid	<i>Universal DOT</i>	P	1	\$0.00	\$10.00	Per Pint	Wilwood		\$782.21
drivetrain	Engine	<i>Hurricane/</i>	P	1	\$0.00	\$747.50	Each	Formula		\$3,792.11
Frame and Body	Assembly		M	2	\$0.00	\$35.00	Per Hour	Formula		\$1,859.04
/Accessories	Fasteners	<i>Mixed</i>	P	20	\$0.00	\$0.23	Each	FMC		\$1,051.31
/Assembly	Assembly		M	10	\$0.00	\$35.00	Per Hour	Formula		\$634.60
Steering System	Rack	<i>#1018783-02</i>	P	1	\$0.00	\$156.00	Each	Unlimited		\$359.82
Shocks	Springs	<i>Fox Vanilla RC</i>	P	4	\$0.00	\$227.00	Each	Racing		\$1,577.32
Bearings and Tires	Wheels	<i>Street 2 6.5-JJX13</i>	P	4	\$0.00	\$45.63	Each	Formula		\$1,591.32

Sub-Total for each Area or Commodity			
		Brake System	\$782.21
		Drivetrain	\$3,792.11
		Frame and Body	\$1,859.04
		Acces.	\$1,051.31
		/Assembly	\$634.60
		Steering System	\$359.82
		Shocks	\$1,577.32
		Bearings and Tires	\$1,591.32
		Vehicle Assembly Cost	50 Hrs @ \$35/Hr
			\$1,750.00
		Grand Total	\$13,397.73

	<i>Bronze Sponsor</i>	<i>Silver Sponsor</i>	<i>Gold Sponsor</i>	<i>Platinum Sponsor</i>
	(under \$200)	(\$200 - \$1000)	(\$1000 - \$2500)	(over \$2500)
Tax receipt				
Name and logo on PSU FSAE newsletter				
Name and logo on website				
Name and logo on clothing				
Name and logo on sponsor board				
Name and logo on car				
Sponsor recognized through media publicity				
Company visit by FSAE				
Premium size name and logo on sponsor board				

SPONSORS

- **FMC Foodtech Inc.,**
- **A.R.E. Manufacturing,**
- **Newberg Steel,**
- **A-dec,**
- **Cheerful Tortoise,**
- **McGuire Bearing Company,**
- **Chehalem Machine Works,**
- **Oregon SAE,**
- **Stewart Warner Performance,**
- **Internet Car Parts,**
- **Allen Heath, Jim & JoAnn Rogers,**
- **Thomas & Karen Godlewski, Larry & Sarah Clark, James & Debra Halter,**
- **Harbor Links Golf Course,**
- **Larry Clark Sr.,**
- **Race Central Inc, (Jeff's Uncle Company),**
- **Kris Horn,**
- **and Instruments of Destruction www.iodclan.net**

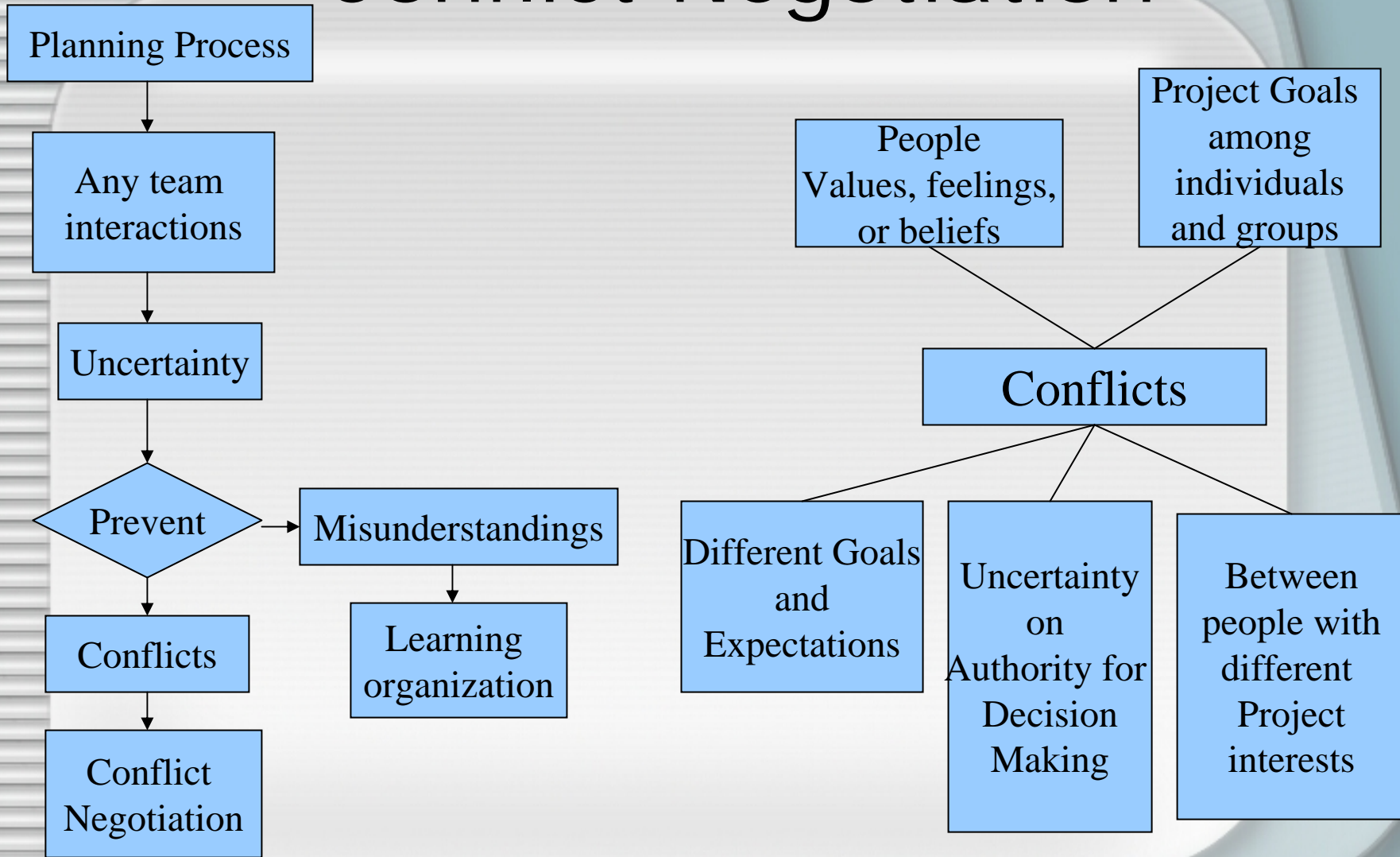
Project Budgeting and Cost Estimating

	Material Costs				
	Item 1	Item 2	X	Y	Z
Brake System					
Engine and drivetrain					
Frame and Body					
Instruments/Wiring/Accessories					
Misc./Safety/Finish/Assembly					
Steering System					
Suspension and Shocks					
Wheels/Wheel Bearings and Tires					

	Labor Costs		
Labor	# Hours	Cost	Subtotal
Direct			
Indirect			
Inspection			
Maintenance			
Tooling			
Assembly			
Other			
Total			

Project Budget by Task and Month							
Commodity/Task	Start	End	Estimate	Monthly Budget			
				January	February	...	December
Brake System	1	2	\$782.21	300.00	482.21		
Engine and drivetrain	1	2	\$3,792.11	2,500.00	1,292.11		
Frame and Body	1	2	\$1,859.04	1,400.00	459.04		
Instruments/Wiring/Accessories	2	3	\$1,051.31				
Misc./Safety/Finish/Assembly	3	4	\$634.60				
Steering System	2	3	\$359.82				
Suspension and Shocks	2	3	\$1,577.32				
Wheels/Wheel Bearings and Tires	3	4	\$1,591.32				
			\$11,647.73	\$4,200.00	\$2,233.36	Σ	Σ

Conflict Negotiation



Conflict Negotiation



Conflict Negotiation

Project Phases

Project Formation

Project Buildup

Main Program

Project Phase Out

10 Common Problems

1. Floundering
2. Overbearing
3. Dominant
4. Reluctant
5. Opinion w/o facts
6. Rush to accomplishment
7. Attribution
8. Discounts and Plops
9. Wanderlust
10. Feuding Team Members

Conflict Intervention Tactics

- Select neutral territory
- Informal setting
- All appropriate people are present
- Set the agenda and ground rules, stick to them
- Manage time carefully
- Use active listening and constructive feedback skills during the session

Team Build Stages

Form

Norm

Storm

Perform

Conflict Negotiation Tools

Written agreement:
PM, Senior Mgt. &
Functional Managers

Project Charter:

Project
Organization

RIM

Ground Rules

Linear
Responsibility
Chart

Reporting
Relation Matrix

Team Building

Resource Allocation

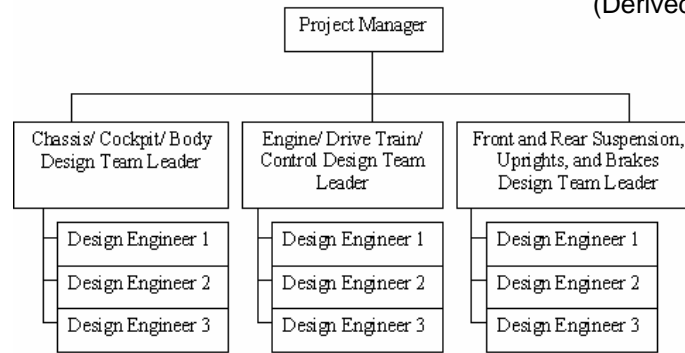
- First Steps
- Resource Loading
- Resource Leveling

Resource Loading

Use resource loading to determine the amount of individual resources required for an existing schedule during specific time periods.

1. Create a RIM (Responsibility Interface Matrix)

(Derived from Dr. Kocaoglu class notes)



- Example Organizational structure →

- Example RIM →

Work Packages	Team Members			
	Project Manager	CCB Design Team Leader	EDC Design Team Leader	SUB Design Team Leader
Product Design Specifications	P	I	I	I
internal search	P	W	I	I
external search	P	I	W	I
final design selection	P	I	I	I
chassis design	R, A	P	I	I
cockpit design	R, A	P	I	I
body design	R, A	P	I	I
engine design/drive train	R, A	I	P	I
rear suspension	R, A	I	I	P
rear upright/brakes	R, A	I	I	P
front suspension 20 days	R, A	I	I	P
front upright/brakes	R, A	I	I	P
controls	R, A	I	P	I
design report	P	W	W	W

P	Responsibility
R	Is reviewed by
A	Approval by
W	Work is done by
I	Provides input
N	Is notified of results

("P" includes A, W, O, N, and R unless otherwise noted)

Resource Leveling

From the RUC:

- Are large fluctuations in the work loads of each resource?
- Is this acceptable?
- If not, resource leveling is required.

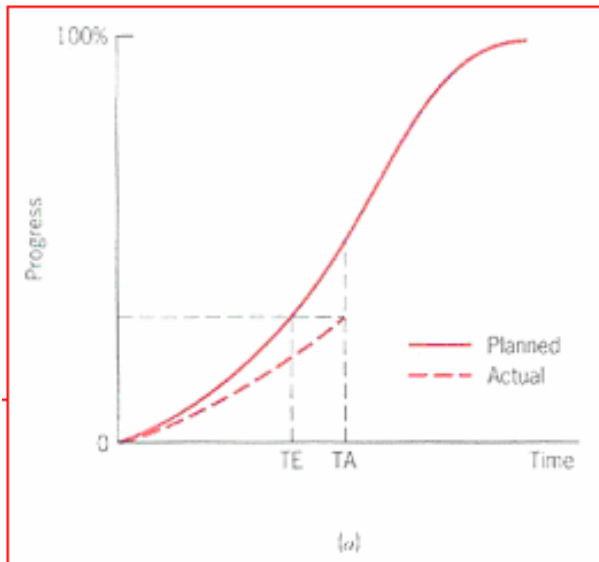
Monitoring and Information Systems

- What information should be monitored?
 - Quantitative Info
 - Qualitative Info
- Reports on project progress should be generated based on data collected

DASHBOARD: PSU Formula SAE Team

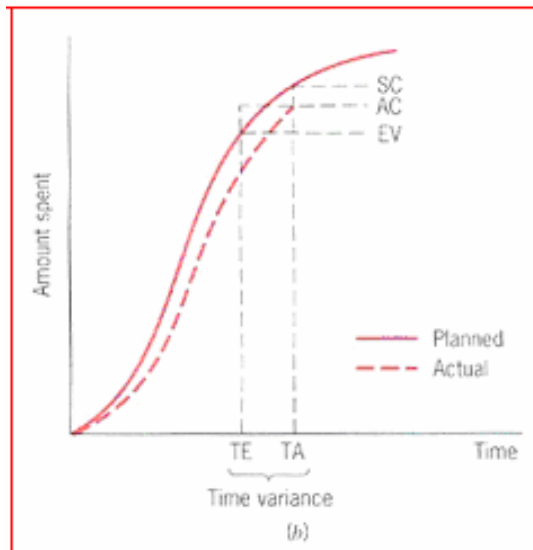
Late Milestones:

1 day Late: [Final Design Selection](#)



Due in the Next 14 days						
Tues	Wed	Thurs	Fri	Sat	Sun	Mon
TODAY	25-Aug	8/26/2004 Team Meeting	27-Aug	28-Aug	29-Aug	30-Aug
31-Aug	9/1/2004 Chassis Design Cockpit Design	9/2/2004 Team Meeting	3-Sep	4-Sep	5-Sep	6-Sep

- ## Project Goals:
- Fundraise \$5000 by December 31, 2004
 - Meet all future Milestones
 - Place in finals at competition



- ## What's New?
- SAE convention November 15, 2004
 - New design requirements for cockpit ergonomics
 - Meeting with advisor about brake design **THIS FRIDAY!**

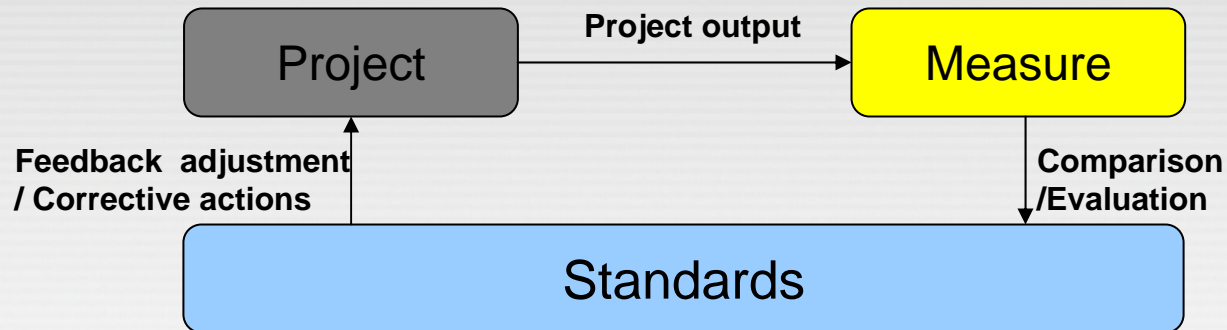
Meetings

RULES (Derived from Meredith pg. 521):

- Avoid status-and-review meetings.
- Use an agenda and stick to it.
- Come prepared to the meeting.
- He who chairs the meeting should take his own minutes.
- Don't put remarks or viewpoints with people's names in the minutes
- Don't make the meeting too formal
- Call meetings for serious problems

Project Control

- Closed loop feedback model



- Project Manager's responsibility
- Performance, Time and Cost

Project Control

- Use kickoff meeting to define standards to use for comparisons throughout each phase and to check status of previous phase
- Analyze the differences between output and standard then set up corrective actions
- Take actions during overlap between phases
- Fortnightly or monthly checkpoints
- Main focus for controls are on Design and Integration phases

Project Control

Common causes

- Performance/Quality
 - Unavailable resources when needed, unexpected technical problems, poor quality parts
- Time/Schedule
 - Unrealistic initial time estimates, technical difficulties, incorrect task sequences
- Cost
 - Price changes, cost overruns, inadequate resources/ fund raised

Project Control

Corrective Actions

- Minor redesign
- Elimination of unnecessary activities
- Revision of time estimates
- Cost minimizing
- Add resources

Project Auditing

- To improve both project and process of managing project
- Project Auditing is a project itself
 - Initiation
 - Baseline definition
 - Establishing and Audit database
 - Analysis
 - Report Preparation
 - Termination

Project Auditing

- Scopes defined during kickoff meeting to audit that particular phases
- Perform concurrently with the project; baseline definition and establishing the database
- Analysis and report should be completed during the overlap between phases
- Need staffs allotted for auditing; advisor
- Brief PM about findings and judgments before releasing the reports
- Focus on Design and Integration phases
- Audit the whole project in Finalization phase

Project Termination

- Termination by Extinction
- Should be fully documented to be used for future competition
- Work concurrently with future team members to transfer knowledge

Project Termination

- Final Document should include
 - Post control report
 - Auditing/Evaluation report
 - Design specifications with actual cost
 - Fund raised, sponsors contacts
- Give all documentation to advisor for future use

Conclusion

- Balance between too much project planning and not enough
- Leverage from previous years
- Organize and follow project plan
- Document and inform stakeholders

Discussion & Questions