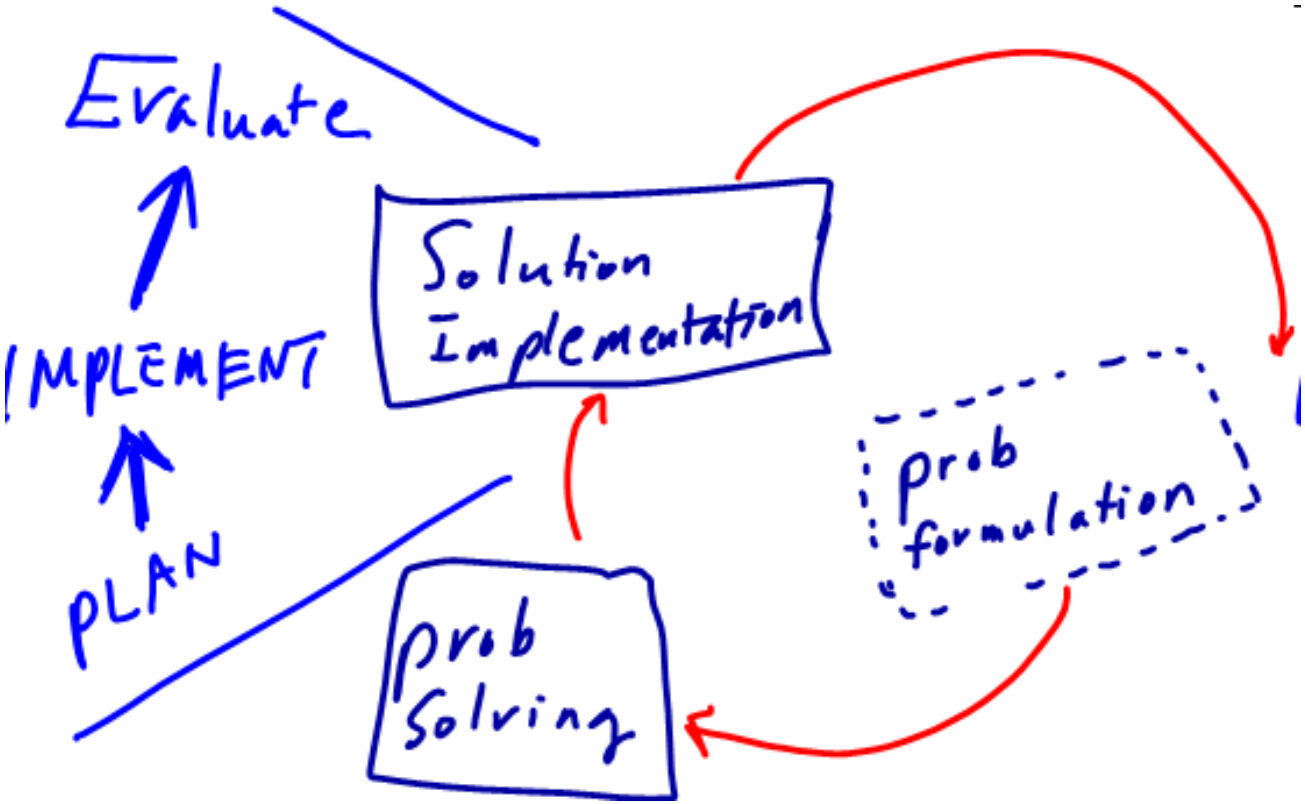
Solution Implementation



Paper Design Into Reality

Objectives

- Steps of Solution Implementation
- Consideration for Implementation Planning
- Elements of Good Test Plan
- Strategy for Evaluation

- 3 C's
  - Commitment
  - Communication
  - Coordination

PLAN

- **What's Involved**
  - **Conversion of Paper Design into Reality**
  - **Make sure the implemented design meets thedeign requirements**
  - **Efficient Process to do the work**
- **PLAN**
  - **"Perception of how to best operate in the future"**
    - **Impossible to know everything in advance**
    - **Opportunities and crises occur unexpectedly**
  - **"A road map to a goal"**
    - **Outline the future**
    - **Coordinate efforts**
  - **Manage the 3 key resources**
    - **Time**
    - **Personnel**
    - **Money**

Detailed Plan for Implementation

- TIME
  - Details of Tasks to be executed
  - The Order the Tasks to be done
- PERSONNEL
  - Who will work on which tasks
- MONEY
  - Allocation of necessary financial resources
- Mutual Understanding of the PLAN

Key Points of Planning -1

- “DETAIL”
  - You can and should be very detailed with your plan
  - Instead of “construction”
    - Breakdown to much smaller tasks;
    - “order motor”, “manufacture brackets”, “align optical components”
  - Instead of “Coding”
    - Breakdown to much smaller modules;
    - “module A”, “subroutines”, “objects”
  - Timeline
    - Gant Chart
    - Spreadsheet
    - Project

Key Points of Planning -2

- “x3”
  - Everything takes longer than you think – even if you think it will take longer than you think.
    - Parts will not arrive when promised by suppliers
    - Building parts yourself will take longer than expected
    - Software coding takes much longer than you think
  - Rule of Thumb
    - (estimated time) x 3
    - Time estimation is learned only through experience

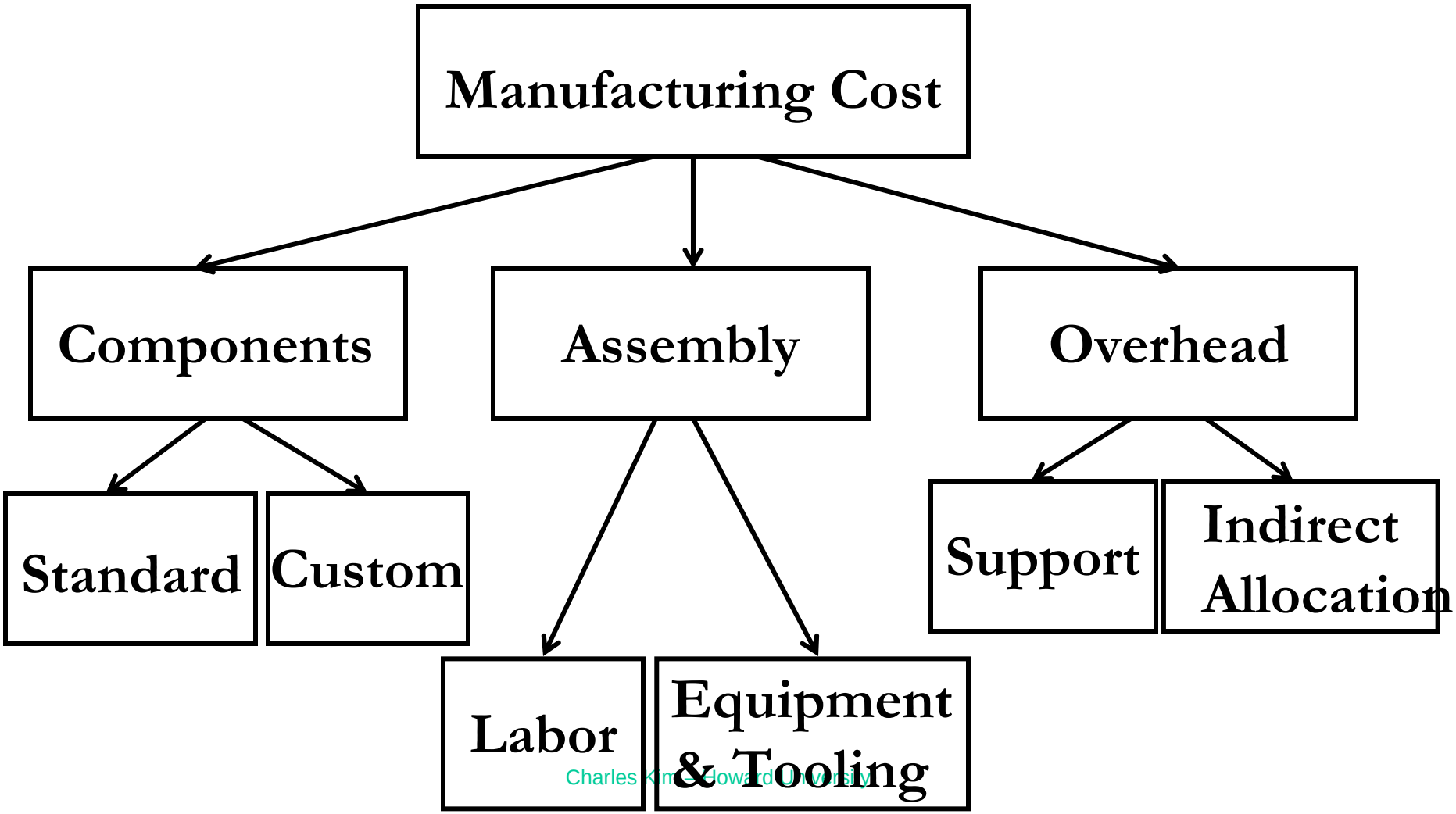
Key Points of Planning - 3

- “SQUARE 1 ?”
  - What if you don’t have enough money or time or people to complete the project?
    - Should have been figured out before
    - Iterate back and reconsider your design
    - Consider a small tweak to save time and money

Consideration when you plan for Implementation and Evaluation

- Focus
  - Produce (implement) high quality product quickly, economically, environment-friendly, etc
- Design for Manufacturing & Assembly
- Design for Affordability
- Design for Reliability & Maintainability
- Design for Sustainability

Manufacturing Costs



Design for Manufacturing/Assembly

- Design for Manufacturing
  - Design for manufacturing is a development practice emphasizing manufacturing issues throughout the product development process.
  - Successful Design results in lower production cost without sacrificing product quality.
- **Design for Assembly**
  - Minimize parts count
  - Maximize ease of handling parts
  - Maximize ease of inserting parts

Design for Affordability

- Money always has an effect on design choices
  - Opportunity cost
  - Risk
  - Need to consider a full life cycle costs for a design, not just initial costs

Design for Reliability/Maintainability

- Reliability
  - probability that an item will perform its function under stated conditions of use and maintenance for a stated measure of time or distance.
  - probability of failure.
  - Mean Time Between Failures (MTBF)
  - Design Redundancy into systems
- Maintainability
  - probability that a failed component or system will be restored or repaired to a specific condition within a period of time.

Design for Sustainability

- Impacts
  - size & scope of impacts
- Environmental Impact of the Design
  - Air quality.
  - Water quality & consumption
  - Energy demands
  - Waste
  - Energy saving
  - Toxicity
- Consideration
  - Choose of design/implementation concept
  - Selection of parts
  - Selection of operating principle

IMPLEMENTATION

- Do it, Grab hold and make it move, Action, Carrying out the plan
- Hardest Step of the Design Process
  - Be prepared to work through
  - Adapt with situation
- **Tips for Success in Implementation**
  - Carefully defined problem –meeting the needs of the customer (Creating a design that meets the requirement, albeit after a few setbacks during implementation-is much better than creating a design that will not meet the requirements even if it is implemented perfectly)
  - Selection of top design by thorough screening process – the best combination to meet the requirements (Experiencing a few problems in the implementation of a clear concept is a much smaller problem than implementing a poor concept flawlessly)
  - Better understanding of the design concept by analysis work (When problems arise, this better understanding is critical in effectively responding to the problems)

Alpha Testing

- Conduction of a pilot (“alpha”) implementation of a Plan prior to complete commitment to it
- “Plan, Do, Check, Act”
  - **Plan** the implementation
  - **Do** it on a simplified or alpha prototype
  - **Check** to verify that the alpha prototype effectively accomplishes the desired results
  - **Act** on the plan by doing a full-scale implementation
- Advantages
  - Errors are relatively inexpensive
  - Adjustments are easy
  - Unexpected glitch does not close down the main operation

Evaluation Plan ("Test Plan")

- Procedures to evaluate a design against all of the design requirements
- **3 types of assessment**
  - Inspections
    - Without extensive testing or analysis
    - Materials are all on the FDA approved list?
    - Press/Release of function buttons
  - Analyses
    - Used when testing is prohibited and inspection is not enough
    - Tall building → scale model experimentation
    - Tank rupture → calculation of volume
  - Tests
    - Experimentations
    - Dropping 2-liter container
    - Vital sign monitored and alarmed if above threshold?
    - Content checking faster?
    - Emergency situation announced with a set time?
- Pick 2 or all 3 for evaluation
- Write **Evaluation Plan (Test plans)** against the measurable/quantifiable design requirements
  - Clear
  - Unambiguous
  - **"Must be possible to hand the plan to someone not involved in the design project and have them successfully conduct the evaluation procedures**"

Evaluation Reports

- Inspection, analysis, and test
- Act of measurement
- Reporting Evaluation Results
  - The background and requirements
  - The exploration of concepts
  - The Final design
  - Results from Testing
  - Summary of the design's Performance of each requirement
- When Design Requirements are Not Met (reasons)
  - Inherent flaws in the design
  - Problems with implementation/manufacturing
  - Unexpected user behavior
  - Artificially restrictive design requirement
- How to respond to unmet design requirements
  - Report what your evaluation indicates
    - Don't fudge data or ignore purposefully ignore some data to make your design look better than it is → Clear violation of engineer's ethical code
    - Documentation of deign steps would help in resolving the problem and explaining how you design a system that did not meet one or more requirements
    - Timely and appropriate communication with project managers and with customer.
    - Extra time into a design process for disappointing tests results

Assignment and Schedule of Feb/March (1/2)

- **Implementation Plan**
  - **multiple“---ability”s must be considered and reflected in the design implementation plan**
  - Presentation File Submission
    - by Tuesday, Feb12,2008
  - Class Presentation
    - on Wednesday, Feb13, 2008
- **Progress Report**
  - Presentation File Submission
    - By Tuesday, Feb 26, 2008
  - Class Presentation
    - On Wednesday, Feb 27, 2008
- **Evaluation Plan**
  - Presentation File Submission
    - by Tuesday, Mar 4, 2008
  - Class Presentation
    - On Wednesday, Mar 5, 2008

Assignment and Schedule of Feb/March (2/2)

- **Project Progress Review Panel**
  - **Contents**
    - The background and requirements of the project
    - Design Concept based on "---- ability"s
    - Alternative Designs/Solutions
    - Screening process
    - The Final design
    - Implementation Plan
    - Evaluation Plan
    - Current Status
    - Plan for near future
  - **Presentation date TBA (Early March)**
  - **Reviewers –Faculty, Alumni Engineers, Industry Advisors**