



Basic Design and Pipe Drafting

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Contents



- 1) Introduction to design concept, engineering design process, how to do design, conceptual design, design cases, design software.
- 2) Introduction pipe drafting and design.
- 3) Steel pipe
- 4) Pipe flanges
- 5) Valves
- 6) Mechanical Equipment
- 7) Flow Diagrams and Instrumentation
- 8) Codes and Specifications
- 9) Isometrics

Lecture Times : Tuesdays EST 14-16 on class days

Tutorial Times: Sunday EST 14-15

Design for Today's Economy



- Other factors need to be considered in order to achieve good design are the
 - Need for **collaborative** design using multi-disciplinary teamwork,
 - **Increased customers requirements**,
 - High product development **cost** and
 - Demand for **shorter development times**.

To achieve this it is necessary to apply a modern and systematic approach to design



Examples of Good Design



- **Quotes :**

- "You see things, and you say 'Why?' But I dream things that never were, and I say 'Why not?'"

GEORGE BERNARD SHAW

- "I believe that quality level is determined primarily by the actual design of the product itself, not by quality control in the production process."

HIDEO SUGIURA, CHAIRPERSON
(RETIRED), HONDA MOTOR COMPANY



Examples of Good Design



Criterion's success is based on a design philosophy that adapts the latest **trends** in furniture style and **functionality** to specific customer needs.



Examples of Good Design



Maxwell recognises that boat owners not only want equipment that **works flawlessly**, they want products that **look great** and **perform** to the highest standards.



Examples of Good Design

“We have been at the
forefront of technology
ever since our earliest
days in the garage”





What's Required?

- Knowledge of the design tools:
 - Understanding client's requirements - needs assessment
 - Interpreting the company's drawings
 - Team-based idea development – brainstorming, etc.
 - Concept development and CAD modelling
 - Use of design workbook and professional presentation of results
- Understanding of the design process:
 - Systematic problem analysis
 - Combination of creative idea development and a systematic approach



How to do Design???

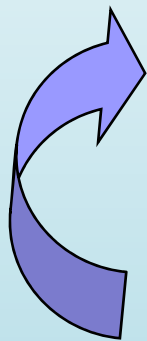
- Problem statement
- Sketching
- Isometric/Orthographic drawing
- CAD
- Design codes/ Conceptual design
- Needs assessment
- Product Design Specification
- Detail design etc...

These are all tools or ingredients in the design process

General Problem Solving Approach



- Both engineering analysis and design require problem solving skills, systematically and structured:
 - Define the problem clearly
 - Collect information
 - Generate and evaluate potential solutions
 - Refine and implement a solution
 - Verify and test the solution
- Generally there are many iterations or feedback loops in this process to achieve the best solution



Characteristics of the Problem Solving Process in Design



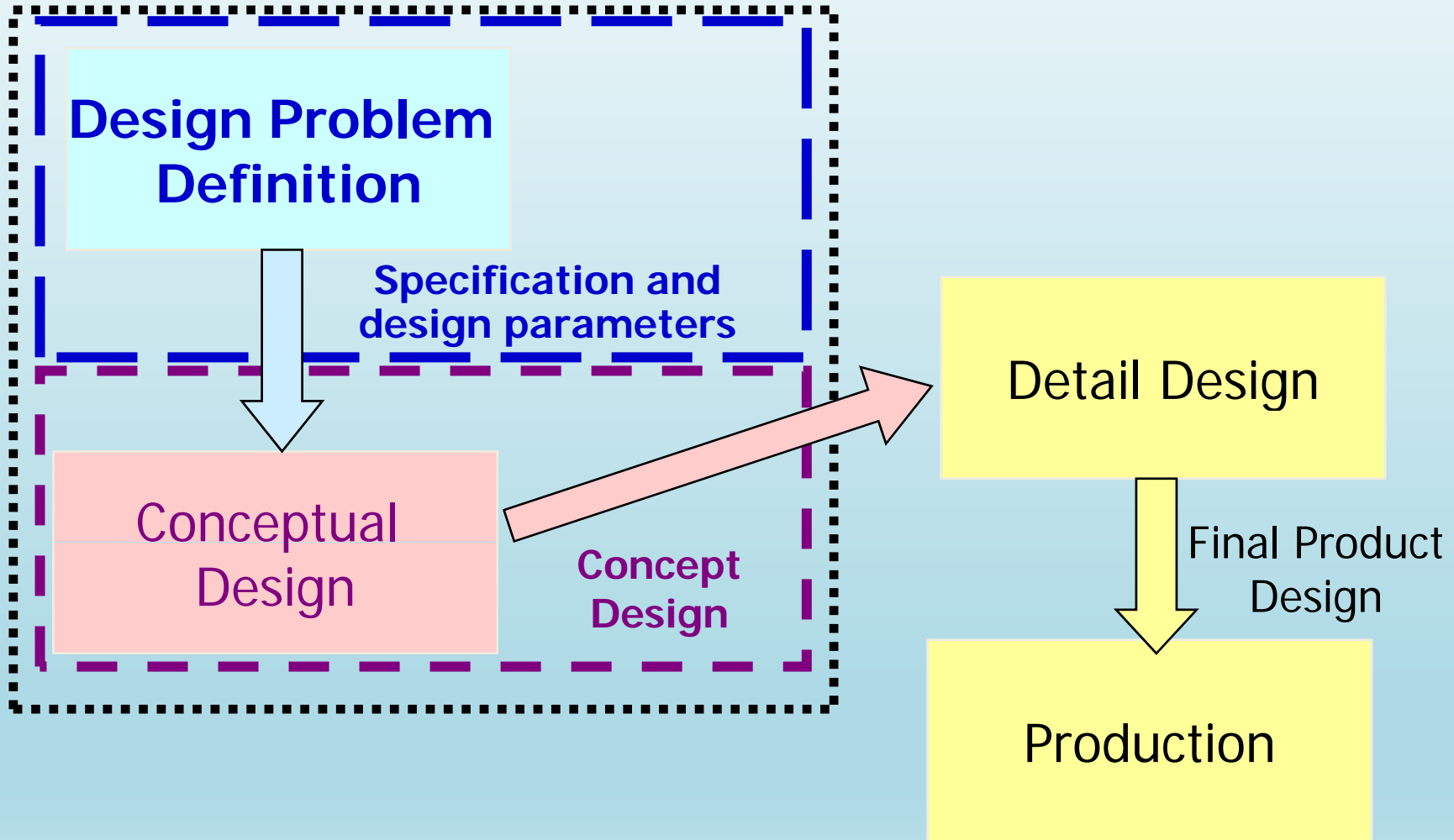
- Engineering problem solving (e.g. engineering design) generally consists of the following elements:
 - Scientific **analysis**,
 - Creative **idea development**, and
 - **Synthesis of a solution**
- Engineering Design is one of the most creative professions: professional engineers create new products, systems and other things, in a similar way as writers, poets and artists create their artwork.

Characteristics of the Problem Solving Process in Design



- Being creative is **fun**: you create something new, something that is uniquely, something that improves the lives of other people, maybe something that nobody has ever done before
- Yet, some engineering design students are **worried** about the ‘open-endedness’ - they prefer the more predictable nature of ‘normal’ scientific analysis

Engineering Design Process



Engineering Design Process



- **Problem Definition**
 - Recognition of a **need** (i.e. a problem or an opportunity)
 - Needs **assessment**
 - Development of a written **design specification**
- **Conceptual Design**
 - Generation of a range of **ideas or concepts**
 - Development and **evaluation** of these concepts
 - Identification of the **best** concept(s), **checked** against design specification

Engineering Design Process



- **Detail Design**
 - **Development** of all details of the chosen design concept
 - **Proof** that design and all its details satisfy the design specification

- **Product/System Implementation**
 - Development of **prototype(s)**
 - **Check** against design specification
 - **Implementation and documentation**



Working in Project Teams

Working in project teams has important advantages:

- You meet **new** people
- It's more **fun** to work in a team
- You have people to **discuss** your thoughts with
- It's much **easier** to create new ideas
- You can **share** the work and won't get stuck easily
- You create **synergy**: the outcome is better than the sum of individual jobs
- You learn for life: team work is becoming more and more important in professional engineering

Design Workbook

| | |
|---|---|
| In this main area write your design notes, calculations, sketches and ideas | Date on each page |
| Never erase any information, just cross out errors | Margin: For any comments, questions, reminders |
| It won't be marked for tidiness, but for completeness and proof of 'evolutionary' development | Also: Important results or things to do |
| | Page # |

- You must use a bound workbook to evolve your design work
 - Use a separate, standard exercise book for this purpose, so that you can hand it in for marking after the project
 - Write your notes in it right at the time when your design proceeds, not afterwards
- Process and record all your development work in your workbook
 - Write in ink and number the pages in the workbook
 - Make corrections by crossing out, not by erasing
 - Glue or tape in printouts from the internet, copied information from books, etc.
 - In this way, your workbook becomes a complete record to trace and document your progress

Design Problem Definition

- Issues to be clarified before design starts

Design Problem Definition

Specifications,
requirements and
design
parameters

Needs Assessment:

What is the design problem?

What is the aim of the design project?

What does the client and the market really want/need?

In what situations is the product used?

What factors and parameters will define a good design?

What are the required functions, design parameters and constraints?

Types of Data Needed for Problem Definition



- User requirements (also called user or clients' needs, objectives, functional requirements)
 - Performance, quality, aesthetics, interface with other systems, effectiveness, serviceability, reliability, maintainability, etc.
- Constraints and controls
 - Legal aspects, materials requirements, manufacturing constraints, life-cycle costs, schedule, logistics, etc.
- 'Systems' requirements
 - Operating environment, human factors, cultural aspects, environmental considerations, etc.

How to Perform Needs Assessment



1. Ask ‘stupid’ **questions** – don’t just assume anything, don’t take anything for granted
2. Use **brainstorming** and other ‘creative techniques’ to develop ideas
3. Use teamwork to share the work and create synergies
4. Use a wide range of **information sources** to get the best data available
5. Write **everything** in your Design Workbook to record and document your work

Common Questions asked in Needs Assessment



- Who needs it?
- How does the need show itself?
- What are the environments within which the need exists?
- What resources, if any, does it require at present?
- What is needed and for how long?
- Where is it needed?
- Why can't it be satisfied by an existing system?
- What are the constraints and limits that have to be observed?
- Etc. ...

Brainstorming

- The Most Popular Creativity Tool



- **Brainstorming** is a technique by which a group attempts to find a solution for a specific problem by amassing all the ideas spontaneously created by its members





Phases of Brainstorming

Brain dump phase

generation
said

Idea trigger phase

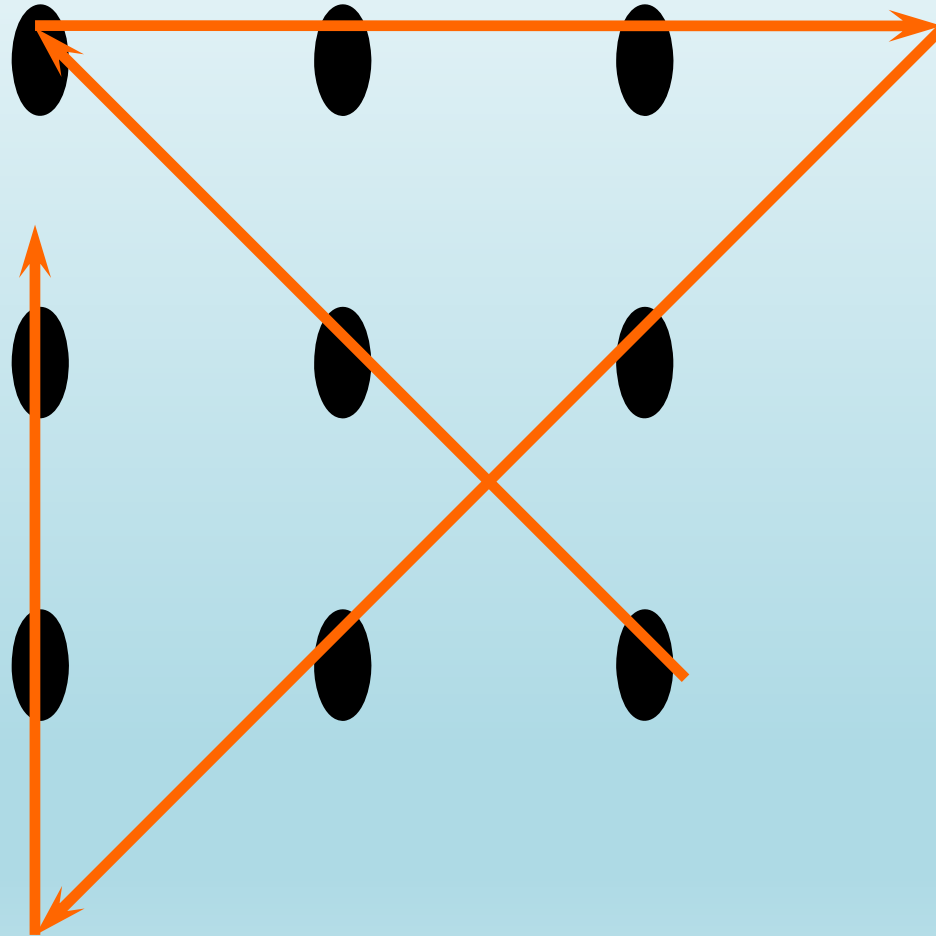
idea to trigger
combined
keep notes

Compilation phase

Compile final
development



Think outside of the Box



Research and Data Collection

Examples of things we want to know:

- General information related to the problem
- Previous solutions to the problem
- Solutions to similar problems
- Constraints and limitations
- Cost
- Planning issues
- Legal issues
- Environmental issues
- Cultural issues
- Etc...

Where we find them:

- Internet
- Technical journals and magazines
- Trade magazines
- Libraries, books
- Newspapers, magazines
- Government publications
- Patent searches
- Reference catalogues
- Professional experts
- Professional associations

Product Design Specification (PDS)

**Specifications, requirements and
design parameters**

Conceptual Design

**Design Problem
Definition**

**Specifications,
requirements and
design
parameters**



**Conceptual
Design**

What are all the possible ways of satisfying the specifications?

What are the most promising ideas that show a good potential?

How can we improve these ideas further?

How do we choose the best option?

How can our selected option be further developed and improved?

Concept Design:

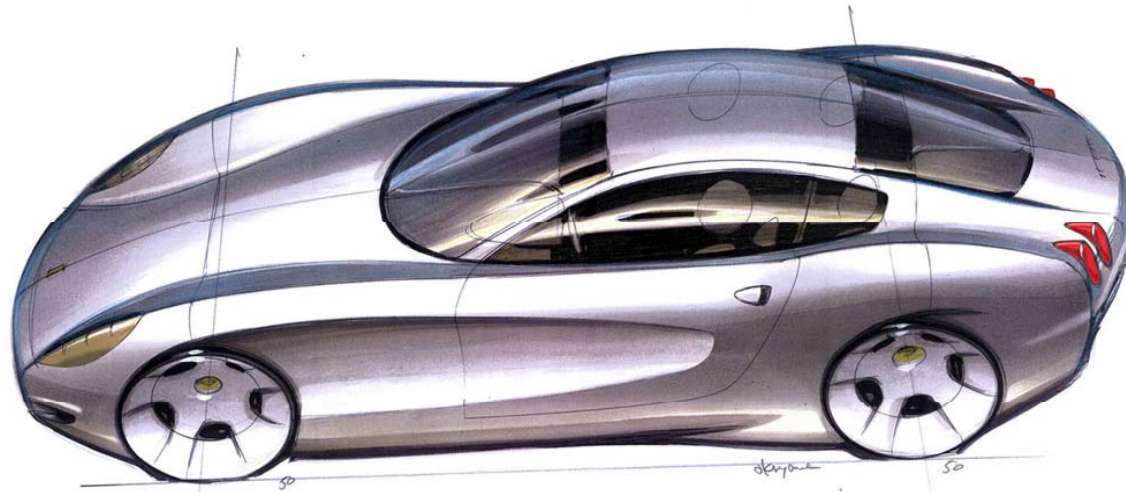
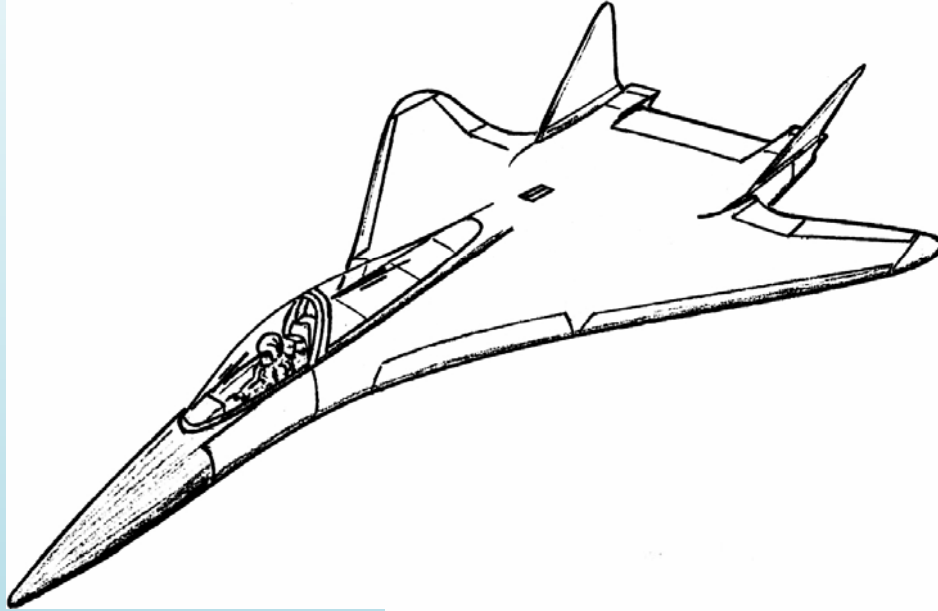
What is the overall nature of the design solution?

What is a Concept Design (or Design Concept)?

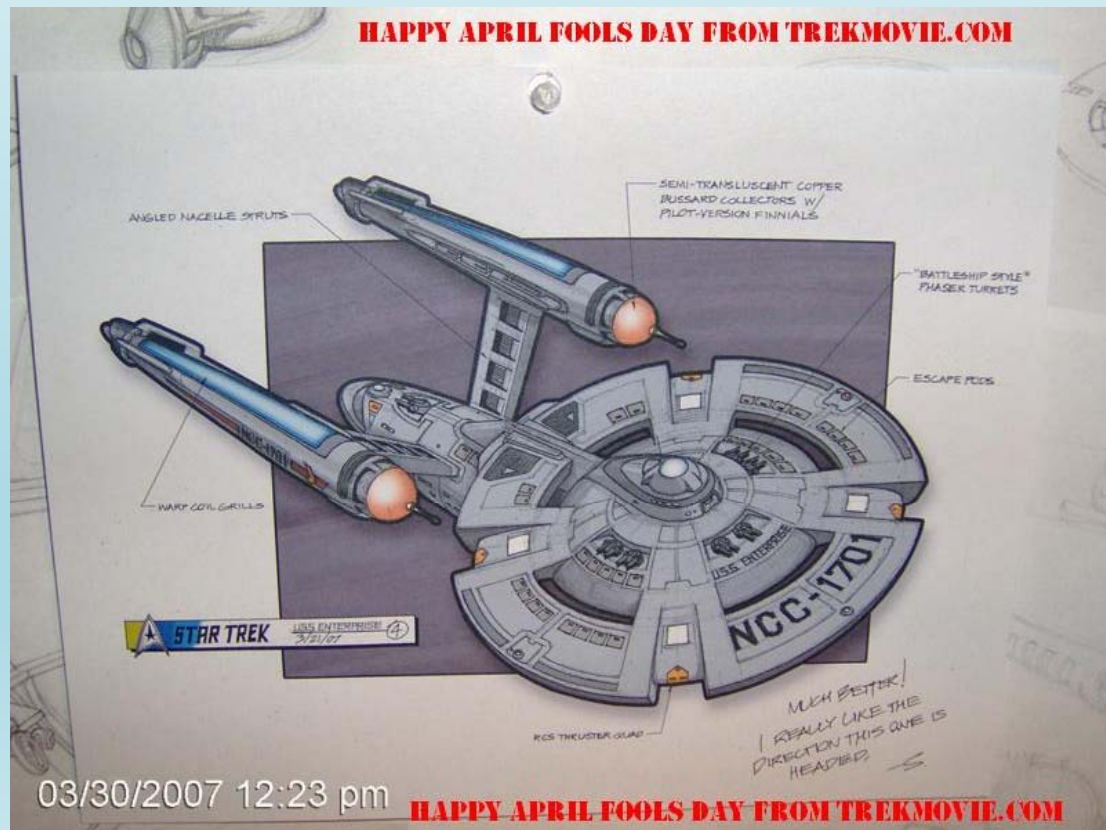
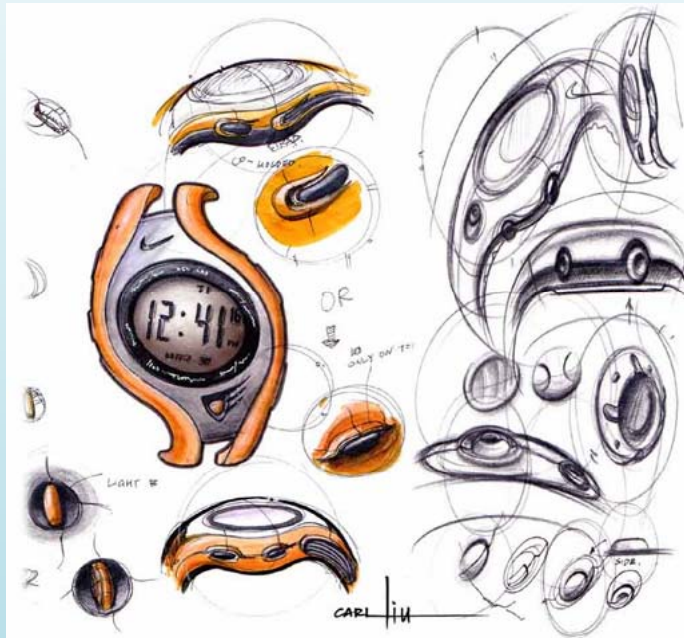


- A **concept design is an outline solution** to a design problem that defines the means for achieving each major function in the design specification
- It also identifies spatial and structural relationships of the major components in enough detail to allow for the estimation of cost, weights, overall dimensions, etc.
- It doesn't include all of the exact details of the design, such as detail dimensions, etc.
- However, it should be detailed enough to **prove the feasibility of the concept, to demonstrate how it works, and enable a detail designer to continue with the design task**

Examples of Conceptual Design



Examples of Conceptual Design



03/30/2007 12:23 pm

HAPPY APRIL FOOLS DAY FROM TREKMOVIE.COM

Examples of Conceptual Design

