03. Project Description
NASA ESMD Capstone Design

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Where in the Process?

Weighted User Requirements → Design Objectives w/ Targets

Team Organization Project Description Quantitative Design Constraints Project Analysis Statement Project Plan Design Evaluation Plan

Design Project Proposal → Project Concept Review → Project Approval Document

Pre-Phase A: Design Problem Analysis
Project Tools Covered

- Project Description
  - The problem description contains the problem statement and objectives. The problem statement begins with what the sponsor supplies and includes problems raised in the background. The objective is what your solution will be in a general form and how it will answer the problems.

Problem Statement

- The Project Concept Statement is a beginning, but elaboration is needed
- What is the current situation how does it differ from the desired situation?
- What is wrong (or sub-optimal) with the current solutions?
- What is missing?
  - Function
  - Cost
  - Analysis
  - Marketability
  - DfX
  - Other
- Sponsor and background information
Information Management Tips

- Become familiar with local information sources (university, employer)
- Develop a personal plan for coping with information (since the world’s technical literature is doubling every 10 years)
- Develop an efficient filing system and keep it current (this means periodically discarding outdated material when replacing with new info)
- Expect to allocate time and money to prevent becoming obsolete

Websites for Basic Information

Some Websites for Designers

- Machine Design Magazine
  - http://www.machinedesign.com
- Thomas Register
  - http://www.thomasregister.com
- National Technical Information Service
  - http://ntis.gov
- Matweb
  - http://www.matls.com

Machine Design Example
“QUIET GEARS”

Go to http://www.machinedesign.com
- In left-hand menu, click on Articles by Technology
- Then move cursor to Mechanical and click.
- Look in Components for Drivelines and click on 1.7 Special Gear Requirements
- See second paragraph: Quiet gears …
Quiet Gears

- To make gears as quiet as possible, specify the finest pitch allowable for load conditions. In some instances, pitch is coarsened to change mesh frequency to produce a more pleasant, low-pitch sound. For quiet gears use a low pressure angle. Use a modified profile to include root and tip relief. Allow enough backlash. Use high-quality numbers. Specify a surface finish of 20µin, or better. Balance the gear set. Use a non-integral ratio so the same teeth do not repeatedly engage if both gear and pinion are hardened steel. If the gear is made of a softer material, an integral ratio allows the …

Sources of Government Technical Information

- Government Printing Office
  – http://access.gpo.gov
- National Technical Information Service
  – http://www.ntis.gov
- Library of Congress - Science and Reference Section
  – http://www.loc.gov
- National Institute for Standards and Technology
Why Is Patent Information Important?

- The U.S. patent system is the world’s largest body of technological information
- There are over 5 million patents, and the numbers increase by about 100,000 per year
- Only about 20% of the technology found in U.S. patents is published elsewhere
- If you ignore patent literature, you will only be aware of the tip of the iceberg

Web Resources for Patent Searches

- Official site for U.S. Patent and Trademarks Office
  - www.uspto.org
- A slew of useful information for inventors, as well as a Tutorial for Patent Searching
  - www.inventnet.com
- For World Intellectual Property Organization (databases)
  - www.wipo.int
03. Project Description

- If you have not yet done a patent search related to your project, identify an area in your Pugh evaluation where having this information about some concepts could be useful.
- Conduct an exploratory patent search in that area. Include a listing or examples of key patents from your search in the Appendix of your Design Project Proposal.

Objectives

- The goal of your project is to develop a solution that alleviates the problems.
- What are the constraints (musts and must nots)?
- What form will this solution take?
- To what level of completion will you carry it?
- What general steps and methods will you take or use to accomplish the objectives?
- What are the deliverables?
- When will you deliver?
Project Concept Statement Example

Project Concept Statement

Design of a Radiofrequency Surgical Probe for Soft Palate Tissue Reduction to Control Snoring and Sleep Apnea

The purpose of this project is to design a surgical probe and the associated low-level radiofrequency generator and controller which would be used by surgeons for shrinking the redundant tissue of an enlarged soft palate and uvula as a treatment for habitual snoring and sleep apnea. With local anaesthetic, the surgeon inserts the insulated probe with a disposable, very-small-diameter, uninsulated needle tip into the soft palate and administers low levels of radiofrequency monitored by thermocouples in the probe. This causes very localized, painless heating damage to the sub-mucosal layers, resulting in a coagulation and absorption of damaged tissue and a stiffening of the palate. Somnicon Associates sponsors the design project and a consortium of physicians from Somnicon will coordinate the design requirements and specifications, Other stakeholders include the stockholders of Somnicon and the health care profession. Major goals of the design include controlled studies within 18 months showing (a) very significant reduction in snoring in patients treated by this procedure, (b) significant reduction of sleep apnea, (c) a virtually pain-free procedure, and (d) virtually no side effects or complications. A multidisciplinary team of two electrical engineers (Jason Mecalf and René Farthing), two mechanical engineers (Jennifer Stanley and Fowler Blanch), a biomedical engineer (Colby Suther), an engineer-physician (Michelle Farmer), and an industrial designer of medical devices (Edward Sofili), designated Team Somnicon, will conduct the project, with Colby Suther serving as the project leader.

(Lumsdaine et al., 2006)

Design Journal

- Hard cover, bound (no rip out)
- What goes in it?
  - All planning
  - All calculations
  - All records of significant data
  - All references
  - All significant thinking about the project
- Enter information directly, not copied in
- Patentable ideas and significant analysis read and witnessed
Design Journal

- Continuous entry
  - Chronological order
  - No breaks
  - No tear outs
  - No erasures (just cross out)
  - Paper is cheaper than engineering time
- Original data, not just calculations and plots, with interpretations
- Graphs, taped in if must, with interpretations
- Entries in ink, pages numbered
- ALL pages dated
- Initial and date any mistake cross outs
- Unfilled pages must be X’d and dated

Use labels on key facts and ideas, have a cross-reference, have an index

Weekly, look over the journal entries and write an interpretive summary
- Great way to not let things slip through cracks

The journal allows the project to be reconstructed (without you) years later
- Everything in your report is backed up by original information in your journal