

## Guidelines for Engineering Project Proposals

A **technical proposal**, often called a "Statement of Work," is a persuasive document. Its objectives are to:

1. Identify what work is to be done
2. Explain why this work needs to be done
3. Persuade the reader that the proposers (you) are qualified for the work, have a plausible management plan and technical approach, and have the resources needed to complete the task within the stated time and cost constraints.

### What makes a good proposal?

One attribute is *appearance*. A strong proposal has an attractive, professional, inviting appearance. In addition, the information should be easy to access. A second attribute is *substance*. A strong proposal has a well-organized plan of attack. A strong proposal also has technical details because technical depth is needed to sell your project.

Remember: A proposal is a persuasive document.

### Required Format

Format consists of the layout and typography of a document. In formatting your proposal, use the guidelines in Table 1. Look at the attached template to guide you.

One aspect of layout is the incorporation of illustrations. In your proposal, each illustration should have a name and be formally introduced in the text. Illustrations consist of figures and tables. Figures include photographs, drawings, diagrams, and graphs. Each figure should have a stand-alone caption, and the key points and features should be labeled. Tables are arrangement of words and numbers into rows and columns. Use tables to summarize lists that the audience will try to find later (the budget, for instance).

**Table 1.** Format guidelines for requested proposal.

Aspect	Description
Font for headings	Boldface serif or sans serif: size in accordance with hierarchy
Font for text portion	12-point serif such as Times New Roman or Book Antiqua
Margins	Standard, at least 1 inch
Layout	One column, single-sided
Paragraphing	Indented paragraphs, no line skip between paragraphs in a section
Page number	Bottom centered
Figure names	Numbered: Figure 1, Figure 2, Figure 3, and so forth
Figure captions	Below figure in 10 point type
Table names	Numbered: Table 1, Table 2, Table 3, and so forth
Table headings	Above table in 12 point type

\* Adapted from Guidelines at the Penn State Learning Factory: <http://www.lf.psu.edu/>

## **Organization**

As given in the proposal template, your proposal should have the following sections and headings:

### **Title Page**

- a. Title of project in capital letters
- b. Team name and individual member names

### **Table of Contents**

#### **Executive Summary**

Content: A brief summary of the proposal

Length: one-third to one-half page, never more than one page

Emphasis: highlighting of the proposed technical and management approach

#### **Statement of Problem: the “Why?”**

Summary of the request by the sponsor (the original problem statement)

Background:

Brief description of company and their business

Relevance or importance of problem

Background information to educate the reader

Previous related work by others—literature review with credible sources

Patent search, if applicable

Detailed problem description, as you now understand it

#### **Objectives: the “What?”**

In the Objectives section, you translate the customer’s quantitative and qualitative needs into clear, objective design specifications. Define the scope of work and clearly state the project objectives, including the following:

- a. Design specifications in specific, quantitative terms. For example, “The plate must be rotated three times at a speed of between 1 and 3 rev/s” or “Control the temperature of a 1liter non-insulated standard glass beaker of water to  $37.5 \pm 0.5^{\circ}\text{C}$  for three hours without temperature deviation.”
- b. Critical design issues, constraints, limitations.

#### **Technical Approach: the “How?”**

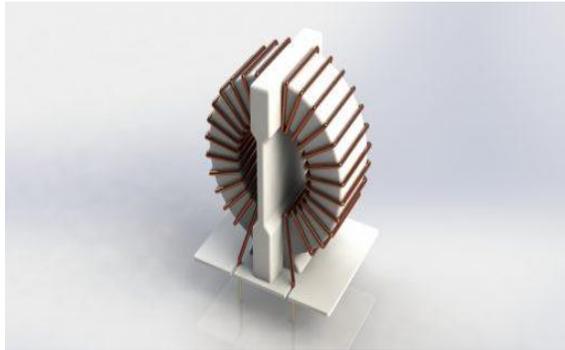
Although you may not know all the details of the problem solution, you should know a first design on how you will attack the problem, and you should have some design concepts in mind. The purpose of this section is to present the *process* by which you will arrive at the final answer.

This section answers the following questions:

- 1) What are the steps in the design process? (Describe and use the nine-step model.)
- 2) What are the benefits and advantages of employing a structured approach to design?
- 3) How will you generate solution concepts?
- 4) How will you analyze the performance of your solution?
- 5) How will you decide on the best alternative?

Specific recommendations for this section include the following:

- (a.) first, describe your overall design process in general terms.
- (b.) provide at least three possible solution alternatives and document your methodology to choose the best alternative. Include illustrations such as Figure 1. Try to be as inclusive and creative as possible with your ideas. Strive to achieve at least one non-conventional or “out of the box” alternative.
- (c.) list and describe all the analytical, or computational tools you will employ to analyze your design, such as ProEngineer<sup>®</sup>, SolidWorks<sup>®</sup>, MathCAD, and MATLAB.
- (d.) list and detail *all the experimental procedures* you will use to test your design concepts.
- (e.) evaluate your alternatives based on how well they satisfy the design specifications. Explain the selection criteria by which you will evaluate design alternatives in specific, quantitative terms, such as cost, weight, reliability, ease of use, and ease of manufacture. A matrix table can clearly illustrate this information.
- (f.) if possible at this time, rank your solution concepts and list the pros and cons of each. At minimum, state what further information or additional work is needed in order to arrive at a final solution alternative.
- (g.) if any solution is totally unfeasible or may have been (see **Figure 1**. Solid model) tried before, state the reason for its elimination (example: filter wheel).



**Figure 1.**

### Project Management: “How and When?”

The Project Management section describes how the project will be managed, including a detailed timetable with milestones. Specific items to include in this section are as follows:

- a. Description of task phases (typical development tasks: Planning, Concept Development, System-Level Design, Detailed Design, Testing and Refinement, Production)
- b. Division of responsibilities and duties among team members
- c. Timeline with milestones: Gantt chart (see Figure 2 for an example). The following are required elements of your Gantt chart:
  - i. Project duration is from the date your project is assigned to the completion date (example: 25th April)
  - ii. Each milestone is to be labeled with a title
  - iii. Schedule *all* tasks not just “Design” or “Testing.” Break this schedule down to specific assignments.
  - iv. Each task is to be labeled with a title and person or persons assigned to the task.
  - v. Subdivide larger items so that no task is longer than about one week
  - vi. Link tasks which are dependent on the completion of a previous task.
  - vii. Continue to update your schedule throughout your project. This tool is important for organizing and viewing the progress of your project.
  - viii. Where possible, avoid a serial timeline (one task at a time, which must be completed before next task can proceed).

**Figure 2.** Example of a Gantt Chart.



## Deliverables

The culmination of the proposal negotiation with your sponsor will be a completed “Deliverables Agreement.” In this section, provide a *detailed* description of what you are providing and when you will provide it. Be as specific as possible. Possible items to include:

- Detailed design drawings (specify Computer Aided Design format)
- Physical prototype
- Scale model
- Engineering analysis (Finite Element Analysis, MATLAB, etc.)
- Economic analysis (return on investment calculations)
- Detailed description of test procedures
- Data from experiments
- Computer program code, flowchart, documentation
- Circuit diagrams
- User-friendly instructions including training for personnel

## Budget: “How Much?”

Provide your *best* estimate of how project funds will be spent for your first design. For an example, see Table 2. The sponsor will allow for only this amount. At this time, you need to know the details for your initial design. You can divide up your budget into some major categories, such as equipment, materials, supplies, shipping, and other costs (that is, for the computerized numerical control, rapid prototyping, etc.).

Remember: You are spending sponsor dollars and the sponsor needs to see that the money is spent wisely. If additional funds or resources are needed from your sponsor compared to their original “request for proposals,” ask for them here but justify the request.

1. Be as exact as you can but estimate slightly higher for shipping. For any quantities, add an additional 10–20% for error.
2. Read all ordering requirements for each company. Some companies have a minimum order amount so you need to be aware of this in advance.
3. You’ll need to have all (100%) your items *ordered and reconciled* by the week before spring break for your first design.
4. Additional funds will not be released after this day without written justification for the deviation (that is, why do you need to go with your alternate choice?)

What went wrong with the first design?).

**Table 2:** Requested items and funds for initial design.

<b>Item</b>	<b>Supplier</b>	<b>Catalog No#</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Total</b>
Vacuum Pump	McMaster Carr	IJ-60825	1	\$183.47	<b>\$188.72</b>
Flow Pump	Northern Tool	CJX-689	1	\$139.99	<b>\$156.62</b>
Water Filter Whirlpool	Lowe's Hardware	WHER25	1	\$33.73	<b>\$33.73</b>
23/32" Plywood 4'x8'	Lowe's Hardware	none	1	\$24.95	<b>\$24.95</b>
4" Ondine Rainmaker	Smartbargain.com	129808	1	\$19.99	<b>\$37.86</b>
Acrylic Tubing 5' (OD 8")	McMaster Carr	8486K626	1	\$236.70	<b>\$250.95</b>
"8" Flange (13" OD)	McMaster Carr	KD-ERW	1	\$44.24	<b>\$44.24</b>
			<b>Total</b>	<b>\$737.07</b>	

### **Communication and Coordination with Sponsor**

Specify the interaction with your sponsor:

- a. Establish communication schedule and the responsibilities of each participant/ team members. See your pacing guide and project timeline for exact dates of progress report, mid-semester presentations, final- presentations, showcase, building fair etc.
- b. Establish a form of communication (visits, weekly updates, conferences).
- c. Specify who will receive information and how it will be transmitted.
- d. Clearly state what actions are requested with each communication: information only, reply requested, etc.

Note: Define any teacher/sponsor/adviser specific items, such as the handling of confidential information, and loan and return of equipment.

### **Team Qualifications: the "Who?"**

- a. In a paragraph for each person, establish the team qualifications for the project. Highlight any specific job or course experiences that are relevant to the project.
- b. Include a one-page resume of each team member in the Appendix. Do not include your hobbies.

### **References**

## Appendix

---

Note: If your first approach has problems you should be ready to switch to your alternate. To do this switch, you will need to submit a revised "Full Proposal."





