Your Grand Challenge Response: Proposing a Design Strategy

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Lecturer-Writing Across the Curriculum
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Agenda

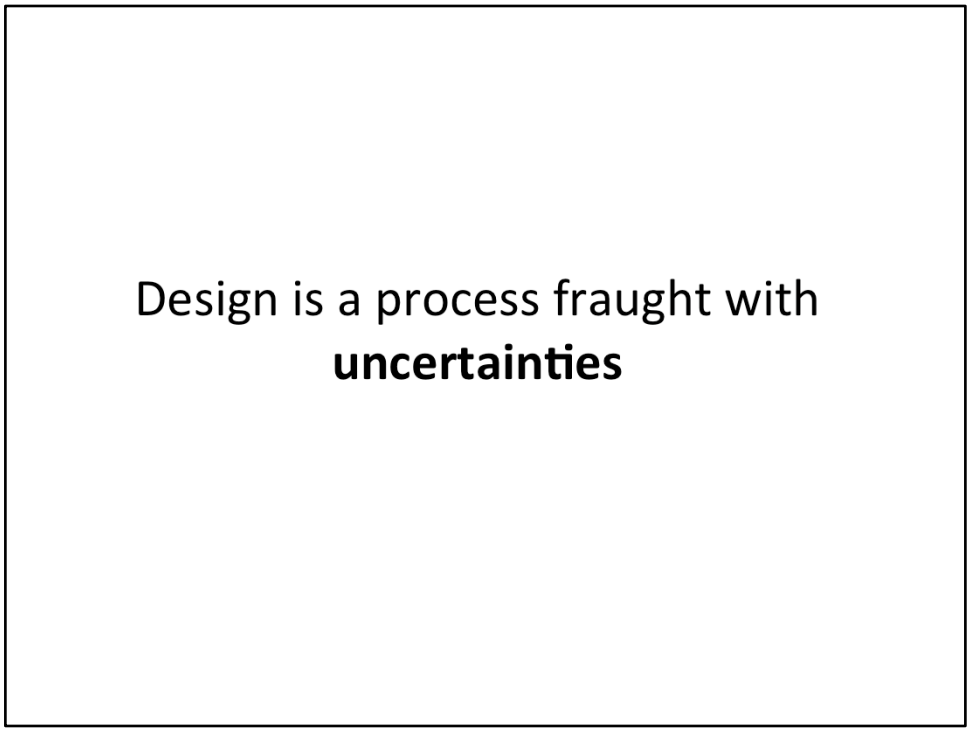
- Connecting with the team
- Starting the proposal
- Structuring information and tasks
- Formatting the proposal for readability

Our goal is to help you understand the requirements for the proposal. In this section I cover:

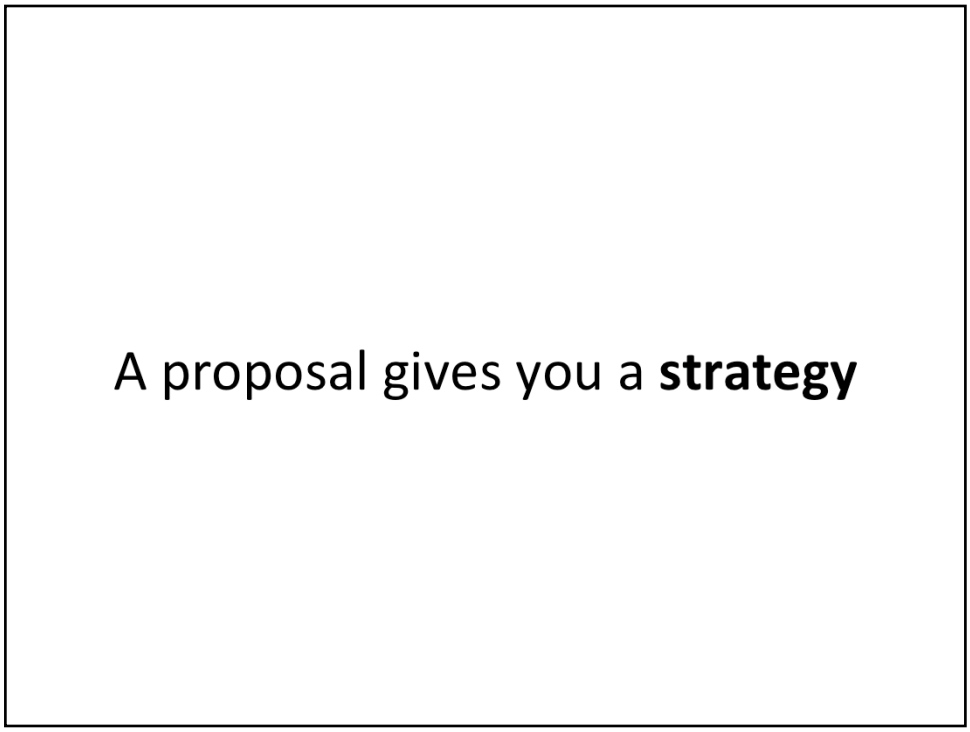
- Using the proposal's **structure** to document and manage your design process
- Assembling the proposal to **inform** your reader
- Making these things happen as a **team**

You have reached the point in the semester where your team will pull together the various concepts you have been learning. The Grand Challenge and the proposal require you to think and work as a team, addressing logistical, technical, and creative concerns.

Everyone is different. You have both individual and shared goals. As you start to work, it's important to acknowledge what you want to get out of the project and what the team needs to accomplish. As creative people, you may find these differences hard to reconcile, but stay with the process. You may find that a "selfish" motive can benefit the team. The team needs to weigh the concerns of the individual over the concerns of the project.



Things don't always go according to plan. Does that mean planning is a waste of time? No. It helps you clarify details and dependencies. You are better able to come up with a Plan B.



When you write proposals, you fill in details. Come up with a strategy for **solving** problems and providing **specific detail** your system

Use the proposal as a tool for documenting the design strategy, allocating tasks to team members, and holding the team accountable for producing deliverables.

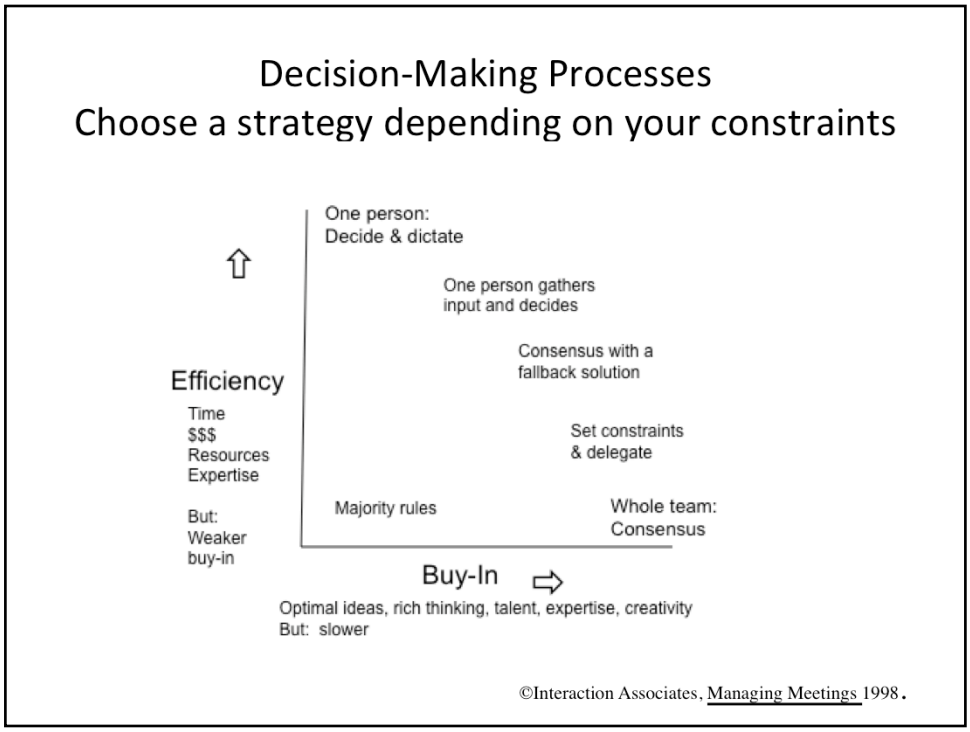
Details help build confidence. They want to know that you have put thought into your design and are thinking realistically about time constraints, the amount of work necessary to get the job done, and potential problems. They want to see optimism and enthusiasm tempered with a realistic assessment of the project.

As stakes become higher

…for instance, when **money** is involved…

the need for **clear plans** becomes even more urgent

We hope that the lessons you learn will carry over into more advanced work.



As you write the proposal, your team will face many decisions, both large and small. Consider which decisions require buy-in from the whole team and which ones can be delegated to a single person. What time constraints are you facing? How would this decision affect the team's work? If the decision interferes with a basic team goal, you need more buy-in and so need to use a process that ensures everyone's voice gets heard.

If I buy a bag of candy to share with the class, I probably don't need to build consensus. But if I make a major (arbitrary, unilateral) change to an assignment, you'd probably be upset. What's the difference between these two decisions? (Cost – in time and effort invested; Our "contract" as students/instructors; My limited authority as just one member of the teaching team)

Goals for the Collaborative Design Proposal

Learning

- CI component?
- Technical component?

Contribution

- CI component?
- Technical component?

Effective project planning includes clarifying your own goals and contributions.

What do you want to learn from this assignment:

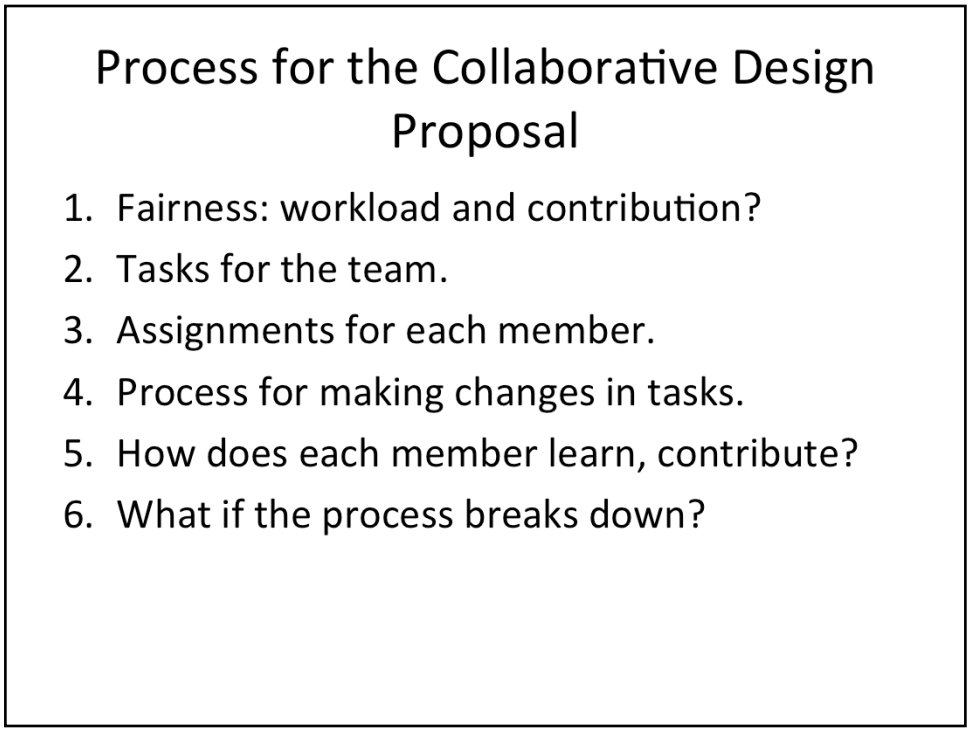
CI component?

Technical component?

What can you contribute to the team in this assignment:

CI component?

Technical component?



As a team, create some ground rules and processes in advance, to guide you in accomplishing the Collaborative Design Proposal.

The following are some, of the tasks you might want to prepare for:

1. Define "fairness," in terms of workload and contribution?
2. Determine a list of tasks for the team.
3. Decide how to assign tasks.
4. Determine a process for making changes in tasks.
5. Ensure that each of you is both learning something satisfying and also contributing something beneficial.
6. Decide what you will do as a team if your process breaks down at some point, and the work is not getting done to your satisfaction.

Expectations

- Introduction
  - Motivation and key technical issues
  - Objectives
- Technical Approach
  - Software strategy
  - Hardware strategy
- Work Plan
  - Gantt Chart
  - Dependencies and fallback plan

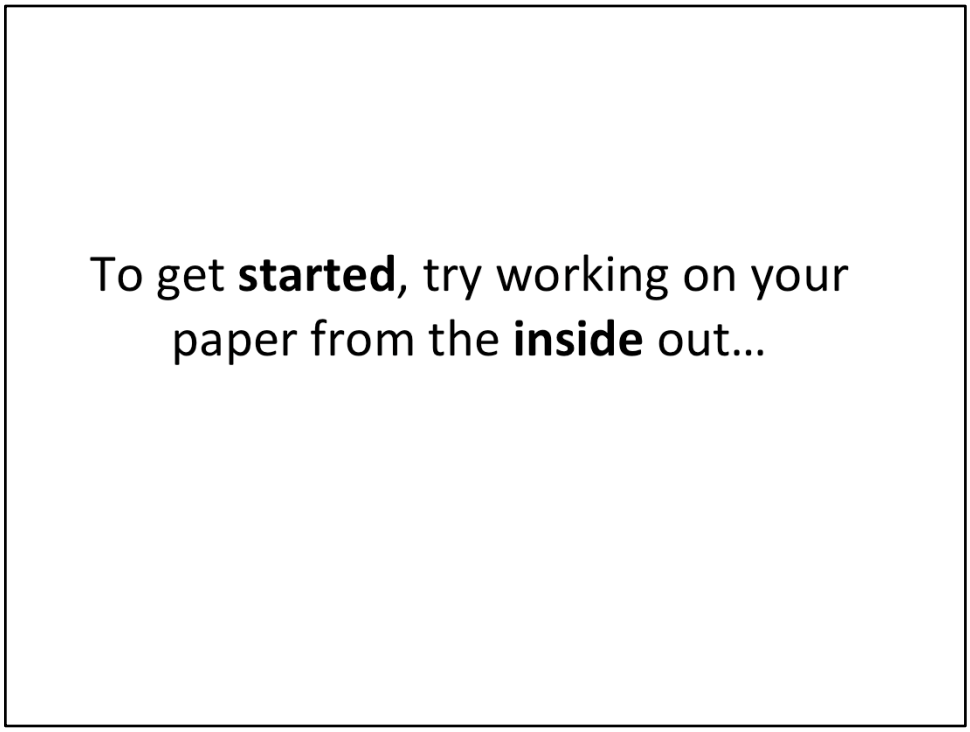
This basic outline shows the main things we are expecting in the proposal. Every design is somewhat different, so take these generic headings and make them as specific as possible to your design. You may also find it helpful to read through the section of the Mayfield Handbook that discusses proposals, available at: https://web.mit.edu/21.guide/www/pro-gen.htm (certificate required)

The steps that follow are ways of looking at these various sections as designers and inventors so that you know your material really well. We'll talk later about how to translate this knowledge into information that helps and informs an audience.

Sections are logically organized

Introduction

Document indicates the purpose of the the writer (s).



How do you get started? Begin by writing up the things you understand or can easily envision. Usually, this means working with the details first. Remember, we are talking about the writing *process* here. You need to assemble the information, then make connections and provide context.

Writing the proposal helps **articulate** the system requirements and your team's assumptions

- What are the **criteria** for a successful robot?
- What are the design **constraints**?

Keep translating design criteria and the demands of the assignment into language that makes sense for you. Don't just repeat the wording of the assignment. Paraphrase the assignment in a way that makes sense to you.

To form the **core** of your proposal, list and explain the design details

- Hardware plan and rationale
- Control architecture and rationale
- Necessary algorithms and rationale
- Software plan and rationale

Start with lists and diagrams. Explain things to fellow team members and then write down what you learned.

Integrate words and pictures

- Design graphics to inform the reader
- Label graphics clearly and correctly
- Refer to the graphic and discuss/ interpret it in text

Most people look at pictures first when scanning a report. Illustrations are often the best way for a reader to get a sense of the design. The report often gets read *because* the illustrations engage the reader.

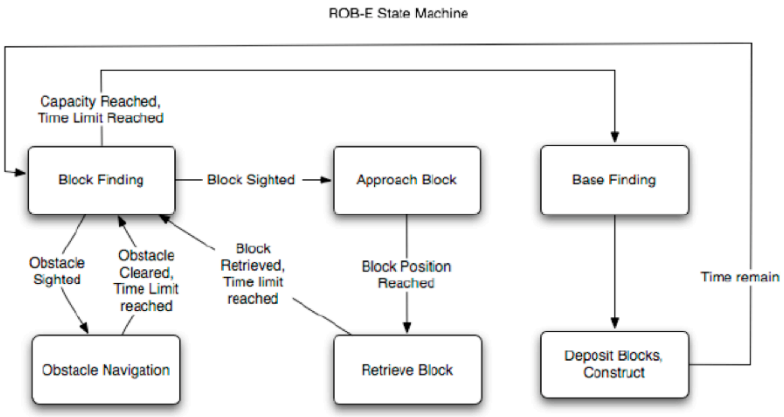


Figure 3: Proposed finite state machine diagram for robot.

Source: Evan Iwerks

Example of a clear, well-labeled graphic. Source: Evan Iwerks

Map out timelines and schedules for deliverables

- Fabrication
- Testing
- Redesign
- Final implementation

Fig 10 – A chart showing the development plan for the task

Source: Evan Iwerks

The proposal's **structure** gives the team a way to organize a **wealth** of detail

Use the proposal to document your design in both words and illustrations.

Introduction: overview of strategy and how requirements will be met

- Context of challenge
- Motivation
- High level overview of the proposed design

After your team has had a chance to document the system details, move outward to the introduction and conclusion, which frame the discussion and provide context. Now that you have lived with the details of your design for a while, step back and ask yourselves why this challenge matters and how your team is responding to it.

The design description in the **body** of your proposal is organized into **systems** and **subsystems**

- Use informative subheadings for details
- Organize information under subheadings
- Read the sections your teammates write

List the systems and subsystems. If you were a reader, could you gain specific information from reading though the headings and subheadings?

Risks and assumptions

- Are there particular risks to your design strategy?
- What assumptions are reasonable, given your design constraints?

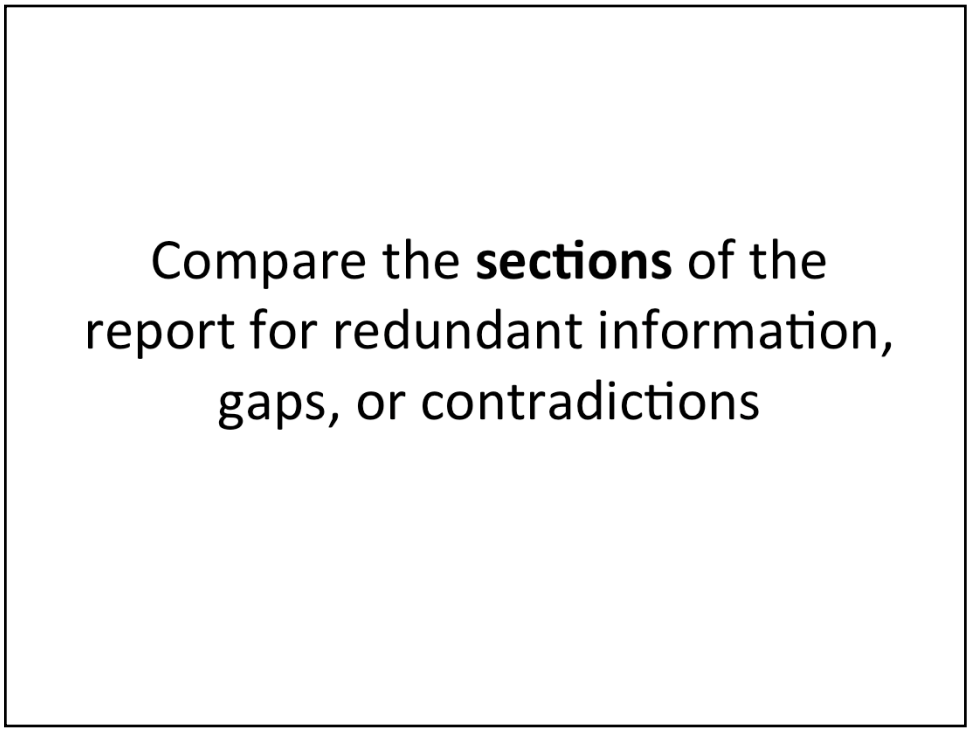
As you write up the risks and assumptions, you may find that team members have different perspectives. This section may be written by just one person, but all team members should have an opportunity to read it.

The conclusion summarizes strategy, tradeoffs, and open issues

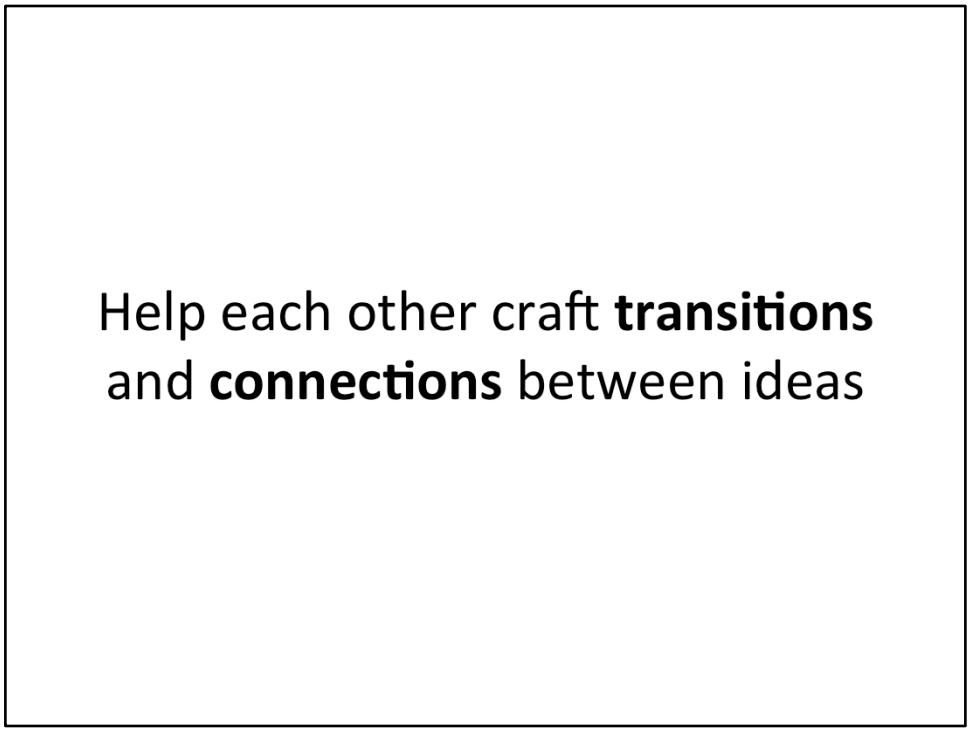
- How does the design fulfill requirements?
- What are the principal tradeoffs?
- How are the tradeoffs justified?
- What issues need to be resolved?

Sometimes it's easiest to draft the conclusion by answering these questions quickly, then rereading the body of your report. Information in the conclusion should follow logically from discussions in the body of the paper.

Documenting a design strategy makes it **concrete**



The **process** of organizing the proposal and making the parts work together identifies gaps in the **team's knowledge**

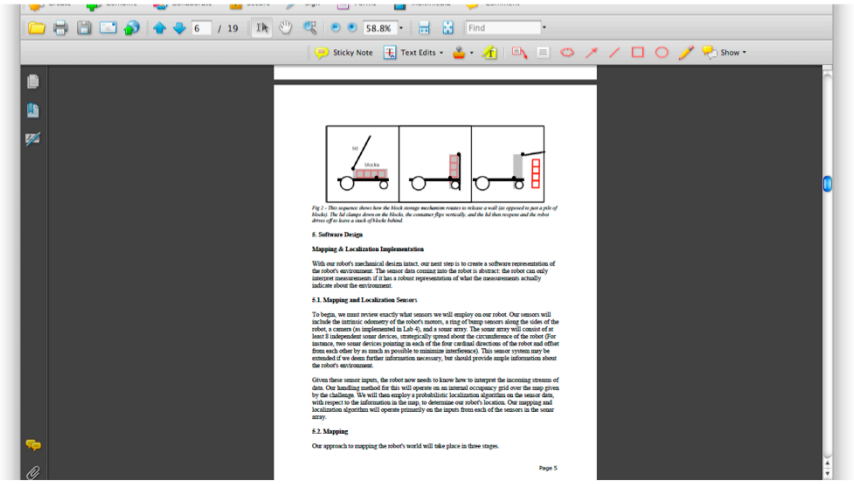


You may want to use the Checklist for a Happy Reader as you review each other's work.

User interface items

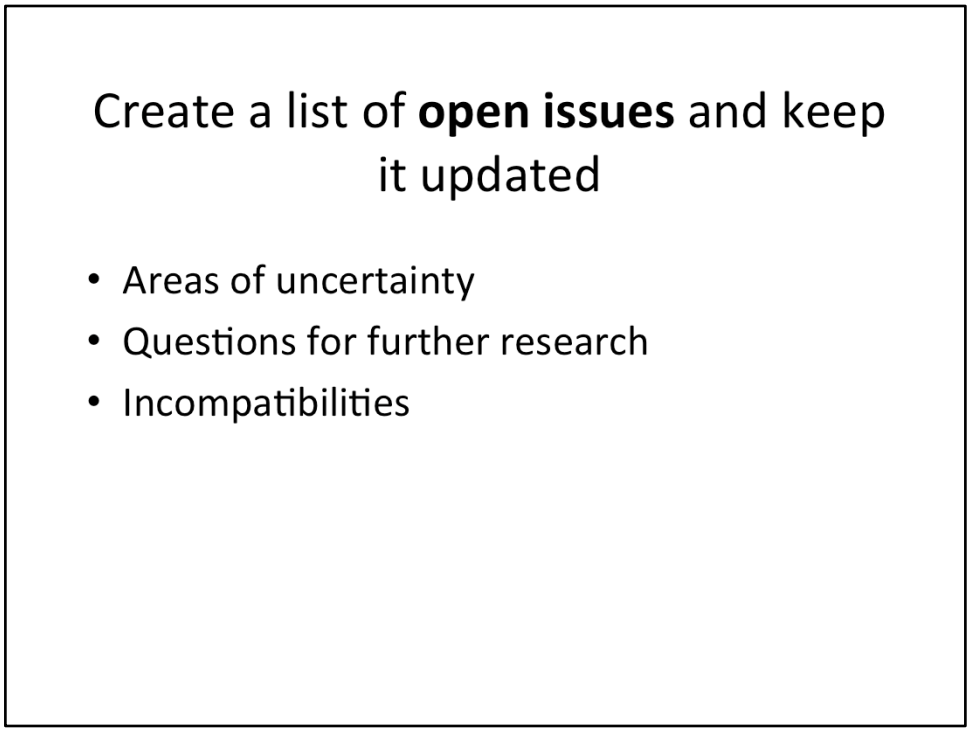
- Include a **table of contents**, properly formatted
- Make sure **headings** convey **useful** information
- **Number** the **pages** of the proposal
- Include team members' names on the **title page**

Design for legibility and easy reference



Source: Kim Jackson

Notice how these writers made effective use of white space and illustrations. Even from a distance, the page layout and illustration communicate clearly.



Listing **open issues** gives the team a to-do list and milestones for the next stage of development. As you prepare the oral report, these questions may help you anticipate responses from your audience.

Innovation forces teams to explore unknown and uncertain territory

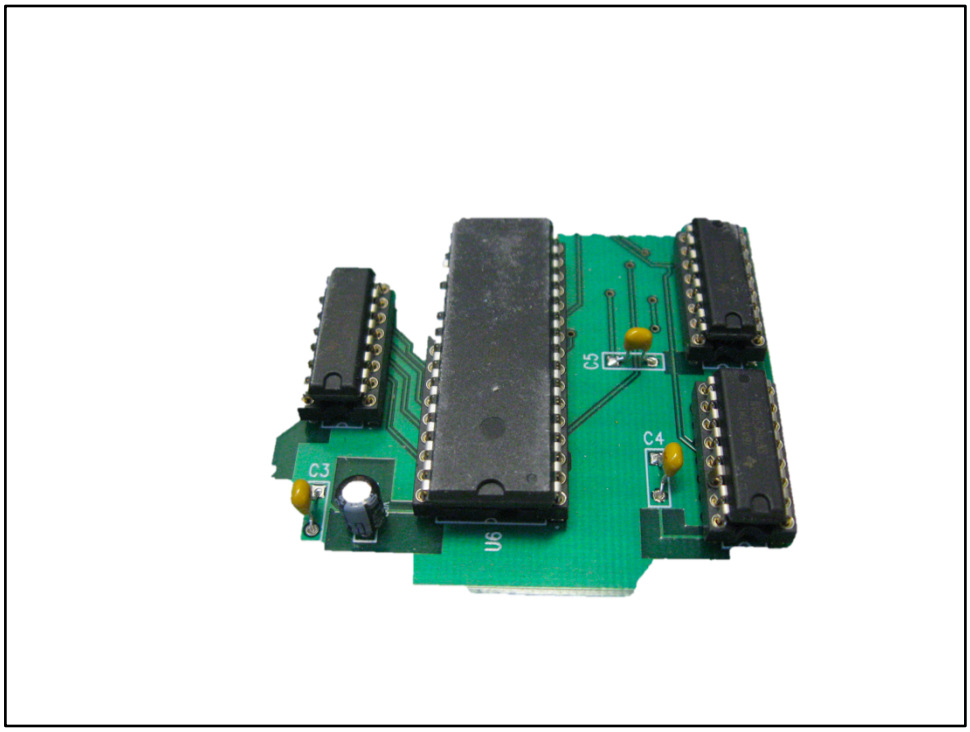
Documenting the design strategy helps to structure the work and articulate goals

A well-crafted design proposal is useful for managers and investors – and for the development team

Proposals establish **strategy**, give a team its **common language**, and are **updated** throughout the cycle of development

Acknowledgements

- Jane Connor for information on teamwork, decision-making, and happy readers
- The 2009 students who let me use graphics from their proposals, especially Kim Jackson and Evan Iwerks
- Professor Rus for the use of the hall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