

# Appendix A

## Templates for Project Documents, Processes, Reports, etc.

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## **Project Proposal Guidelines**

*\*Outline and Advice for crafting a project proposal to use with Projects as well as other instances where you need to convince a faculty advisor or client to work with you on your project.*

*\*Consult with your advisor as well*

### **Goals of Project Proposal**

- **Convince** the faculty advisor and/or client that the project is both worthwhile and feasible, and that the proposed approach is the best possible
- **State** the goals of the project and what the faculty/client can expect to see accomplished
- **Specify** a time limit and budget for completion of the project
- **Identify** milestones by which the faculty/client can monitor the progress of the project
- **Clarify** the relationship between the faculty/client and the project team; in particular, to state what data and services the faculty/client is expected to provide

### **Suggested Outline**

- **Executive Summary** – 1 page statement of project goals, emphasizing the benefits to the university/department/faculty/client, outline of methodology, and statement of time and budget required.
- **Introduction** – 2-3 page statement of problem context (background) and problem essentials (foreground).
- **Project Statement** – 1 page expanded statement of goals. Clarify the deliverables of the project.
- **Methodology** – 5-10 page description of approach to be taken. Organize in subsections. Emphasize the motivation for the approach and the advantages and disadvantages of the approach. As necessary, provide definitions and a brief technical outline.
- **Resource Requirements** – Identify software, hardware, facilities, space, funding and data required for project completion. Identify what data you will collect, and what data and services the university/client will provide. Set up a method for the client to monitor the project through measurable accomplishments, milestones, and a meeting schedule with the client.
- **Budget** – This section is not required for most M.Eng. Projects but is an essential part of any other proposal. Outline monetary requirements for the project along with a schedule for expenditure.
- **Contacts** – IT may prove useful to identify all parties involved with their contact information

### **Tips on How to Write a Project Proposal**

*Use typical sales techniques to create a better proposal.*

- Know your client
- Know their needs and address them
- Use *positive* language
- Promise only what you can deliver
- Understand the difference between *needs* and *wants*

*Consider the possible negative outcomes of your proposal so that you may avoid them.*

- Rejected
- Accepted but you didn't want it
- Oversold – the client expected more than was intended
- Underfunded – possibly the result of the project being over-scoped

Individual's Weekly Report

Due every \_\_\_\_\_ at \_\_\_\_\_ in \_\_\_\_\_

Name:

Sub-teams:

Date:

What **primary** accomplishments did you make in terms of the two deliverables in last week's report? Did you encounter any difficulties? How did you resolve the problems? (**Task and Accomplishment**)

1.

2.

What **secondary** accomplishments did you make in terms of the two deliverables in last week's report? (**Task and Accomplishment**)

1.

2.

*What are your two primary tasks for the coming week? By next Monday, what will your deliverables be? Will you work with any other members? If so, who? Do you need any help?*

1.

2.

*Do you need to devote extra time to any commitments outside the team such that your performance and quality of work may be affected this coming week?*

*Do you have any general comments or questions for the leaders or faculty?*

*Nomination for Hard-Core award last week? \_\_\_\_\_*

*How was your time distributed among the activities/projects last week? Please fill in below.*

Activity/Project	Meetings	Research / Design	Planning / Organization	Manufacturing / Maintenance	Testing	Other
<b>Total Hours / category</b>						

**Total Hours:**

## Sub-team Meeting Minutes

Minutes of \_\_\_\_\_ Sub-team  
Date \_\_\_\_\_

Attending:

Absent with Apologies:

Absent without Apologies:

Sub-team Task List:

<u>Issue</u>	<u>Task</u>	<u>Who Assigned To:</u>	<u>Due Date</u>	<u>To be checked by whom</u>

[ or may be attached as a Excel Spreadsheet]

**Discuss Actions and continuing issues** (items not yet put on Sub-team Task List):

# Design Review Process Guidelines

## Concept

The design process is structured to guide the team through the brainstorming, evaluation, calculation and documentation steps necessary to maintaining Cornell's high level of performance at competition. Three or more stages of design review can be used to move from concept to reality. The deadlines for each stage must be met or we will begin manufacture late and at a distinct disadvantage to our competitors. Additionally, they allow the faculty advisor and the team leaders to keep track of progress and design details and offer suggestions for refinement. The process is an important part of the systems engineering concept that drives successful development and it is a structure routinely followed in industry. At design reviews each sub team should work collectively to prepare a brief summary of the system and then each sub team will meet for reviews throughout the day.

## Preliminary Review

This is an opportunity to obtain feedback on the various concepts you have been examining since beginning your research. These concepts should prove that you have successfully and completely defined the problem (calculations, tests...) you are trying to solve and have examined fundamentally different ways of solving it. The concepts should be developed to the point that you have component sketches and a beginning analysis of performance, cost, weight, packaging, fabrication, etc procedures. Intersections with the sub-systems should be outlined. Copy relevant pages from your notebook so that you are able to track your design and obtain help when necessary.

## Secondary Review

The secondary review should focus on one, possibly two, designs that you are examining in detail and plan to use on the final project. The state of your analysis should be nearly complete and include all relevant diagrams and calculations. You should be relatively confident of the physics, etc, involved in your secondary design. In addition to showing a higher level of analysis of important aspects such as forces, stresses, heat, etc., you should have a solid idea a trade-offs analysis (i.e., cost vs. performance vs. weight) and present your opinions on what trade-offs seem best for a final design. Show consequences of how your system interacts with others and what interfaces are needed. You should also have begun entering you drawings into CAD and present any part drawings you have.

## Final Review

This is the formal and final acceptance of your designs and the transition to manufacturing. Your parts should be fully modeled in CAD and assembly drawings should be generated as appropriate. Sheets that document your final calculations of part performance and safety considerations must accompany the relevant pages in your notebook. The level of detail of the final design should be adequate to allow any other team member to accurately fabricate and assemble your parts and attach them to the final project.

## Conclusion

The design review process is rigorous. Cornell performs well at competitions when our teams create intelligently integrated designs that translate well to fabrication. Design reviews help keep the advisors and leaders informed and allow you a chance to get feedback on your ideas. System interaction, tradeoff, and manufacturing issues can be determined before the final project is built, when significant design changes eat into valuable testing time.

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# Dimensioning and Tolerancing

Prepared by: Michael Hypes  
Cornell University

## Preparation:

One of the most common problems for new designers is choosing dimension that do not reflect the purpose of the part. Let us consider a nominal 1/4" hole. Most new designers will simply put 0.25" or 0.250", but in many cases this isn't what was intended. Tapped holes, ones where you thread the hole, require a smaller hole be drilled, while clearance holes require a slightly larger hole be drilled. Press fits are generally the only 1/4" hole that actually requires a 1/4" drill. Once you know the intended uses of all your dimensions it is much easier to select the proper dimensions. A list of drill sizes for tapped and clearance holes is available online or in the machine shop.

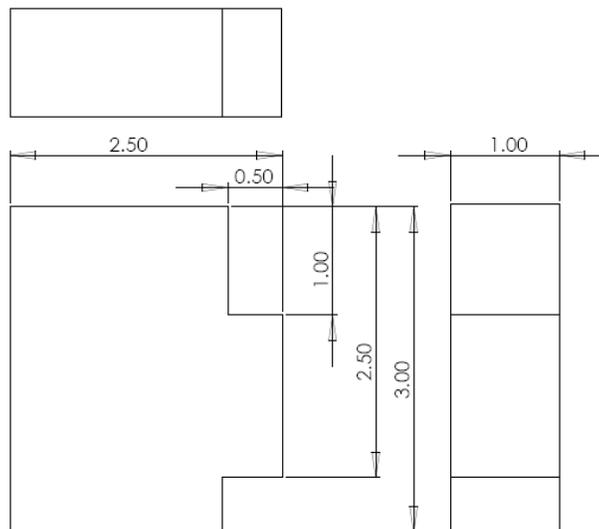
Hole Type	Drill Size
1/4"-20 Tapped	.2010 (#7)
1/4" Dowel Pin	.2500 (1/4")
1/4" Close Fit	.2570 (F)
1/4" Free Fit	.2660 (H)

**Table 1:** Drill sizes for 1/4" holes in aluminum

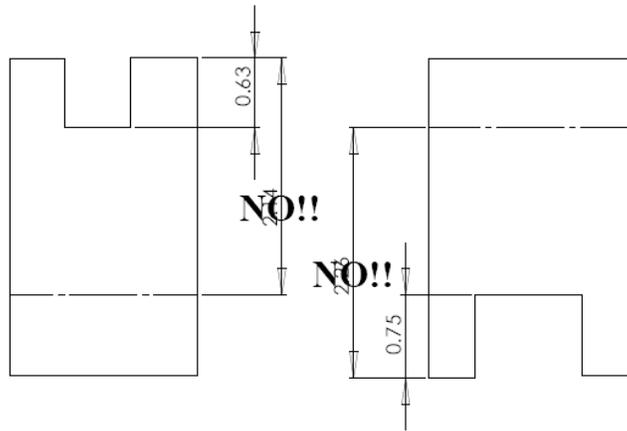
## Dimensioning:

There are a few simple best practices which can help us dimension a working drawing:

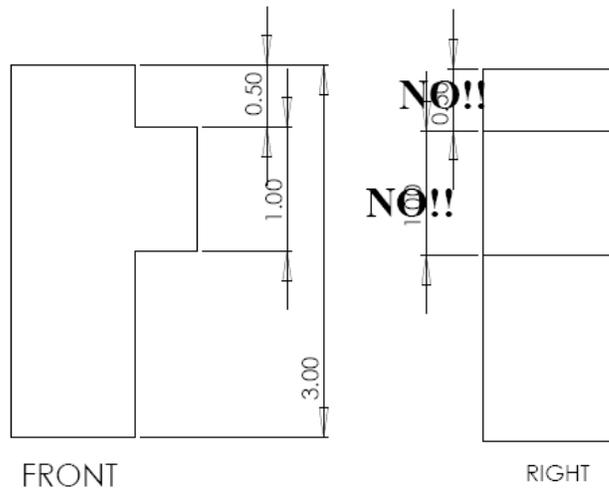
1. Place dimensions between views sharing dimensions, when possible



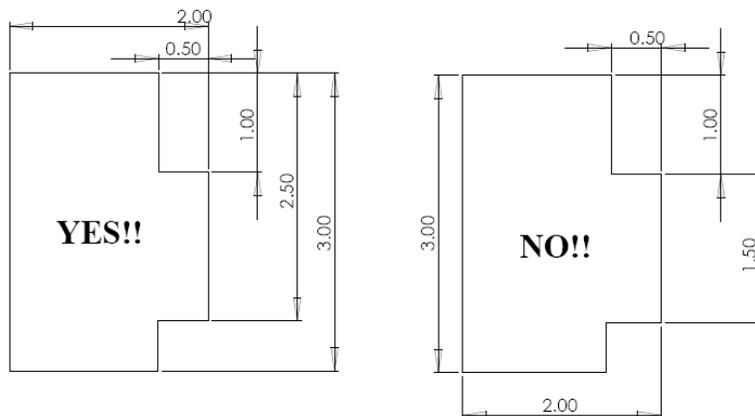
2. Do not dimension to hidden lines



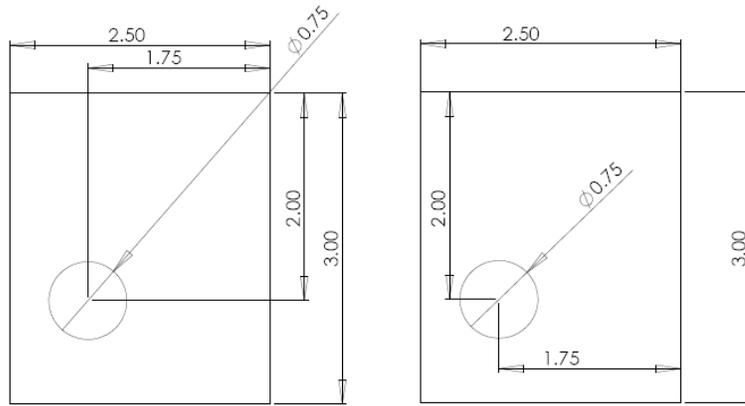
3. Dimension in a view that shows the geometric characteristics of the part



4. Group and organize Dimensions



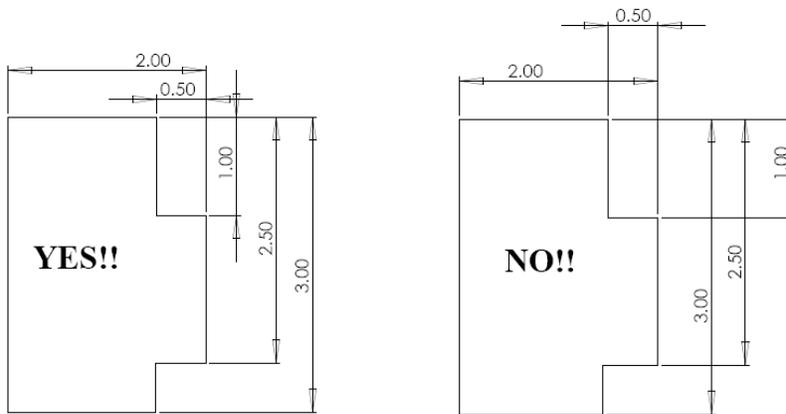
5. Do not place dimensions on the views



**YES!!**

**NO!!**

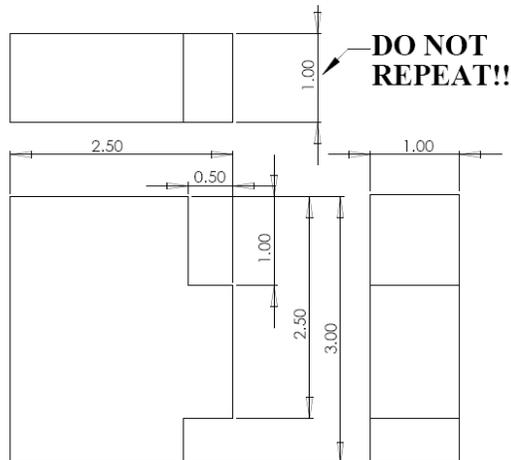
6. Dimension the shortest features first and move away from the view



**YES!!**

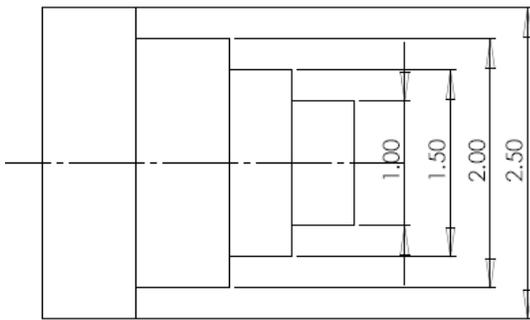
**NO!!**

7. Do not repeat Dimensions

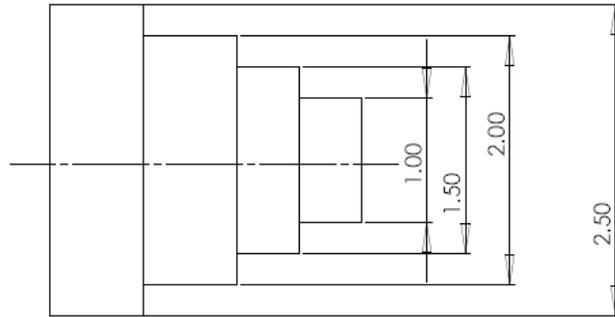


**DO NOT REPEAT!!**

8. Stagger dimensions to make the part easier to read

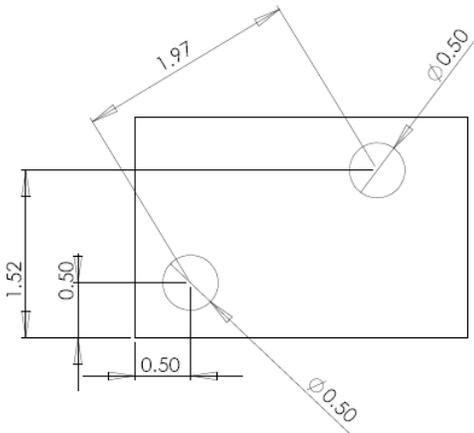


**NO!!**

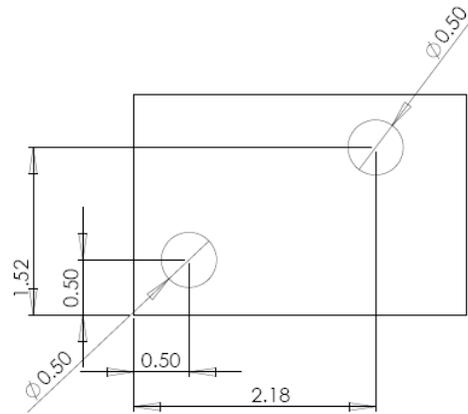


**YES!!**

9. Dimension along a given coordinate system rather than using center to center dimensions



**NO!!**

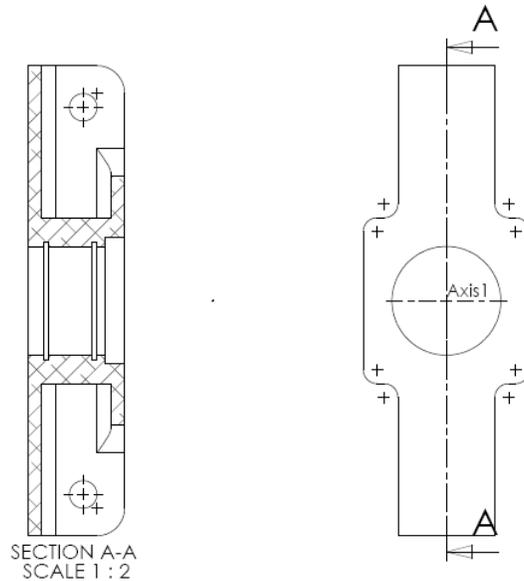


**YES!!**

10. Use the same number of significant figures for all dimensions with the same tolerance

See Tolerancing Below

11. Use cut-away views to show internal features



In addition to these best practices, it is helpful to consider how the part will be made. When using a mill, we generally define an origin either from one corner or a hole, if you dimension from different edges, it requires resetting the origin and can lead to alignment problems. When using a lathe, we generally define our coordinates from one face and the diameter of the part. In addition, as the lathe produces axisymmetric parts the most useful view is the view where the part appears as a rectangle.

### **Tolerancing:**

When dimensioning parts, it's very important to consider how precisely the part must be made. Many teams choose to have tolerance guidelines. An example of one of these conventions is 1.234 means  $\pm 0.0005''$ , 1.23 means  $\pm 0.005''$ , 1.2 means  $\pm 0.05''$ , etc. . .

Using just one tolerance level may not be the best choice. Let us consider a jig plate. The distances and locations of the holes may need to be accurate to  $\pm .0005''$ , but the external dimensions of the plate may be able to vary up to several inches. Having lower tolerances which do not affect the quality of the part can speed manufacture.

Also, you can use one-sided tolerances; these are common when there's a maximum or minimum size. Let us consider making a pair of stacking boxes, one with an inner length of 3'' and one with an outer length of 3'' nominal, but each box will be made by a different person. To make sure that the boxes will fit together no matter what: the smaller box could be dimensioned to  $2.995 \pm .005$  and the larger box to  $3.005 \pm .005$ . However, then we find that if everything is produced to specification we'll end up with a gap of  $.010''$ . Instead to keep reasonable tolerances we can make the smaller box  $3.000'' +0/-0.005$  and the larger box  $3.000'' +.005/-0$ .

Finally, avoid accumulating tolerances. If you dimension off of one feature rather than dimensioning off of subsequent features it is possible to avoid large tolerances on the overall part. However, you should still keep important dimensions and always consider what

dimensions on a part are critical. For example, if 3 holes need to be +/- .0005" from each other, they should be dimensioned off of each other, but the far edge should not be dimensioned off the 3<sup>rd</sup> hole to keep the overall part dimensions within tolerance.

## **Preliminary Design Form**

Please TYPE this form in this template and expand the space for answers as needed  
(Four copies of this form are to be brought to the review meeting)

**Name the part you are documenting:**

**List all responsible parties for this part and underline the single point-of-contact:**

**Explain the general purpose and function of this part:**

**List the Goals and Requirements of the part, including competition rules that will affect the design of your part:**

**Describe all major interactions and physical interfaces with other systems in which your part will have to be designed to interface with. Elaborate on any difficulties you may encounter when designing your part to interface well with other systems. You may also want to make comparisons with previous years' part:**

**a. Interaction (influence on other parts)**

**b. Interface (boundary, size, what connects to it?)**

**Please list at least 3 ideas for this part. For each idea list the pros and cons in relation to your subteam goals:**

1. Idea 1
  - Pros –
  - Cons –
2. Idea 2
  - Pros -
  - Cons -
3. Idea 3
  - Pros -
  - Cons

**What is your plan for determining which idea to pursue for the project? What tests will you conduct and what criteria will you use to make your decision? Give timeline for how you plan to prepare for Secondary Design:**

**Timeline (Dates AND Milestones):**

**Give a rough estimated cost for each of the ideas (in \$, in design time and in manufacturing time):**

**Everyone responsible for this part should list what they have read (reports, articles, books) or have otherwise learned about through important conversations, emails, etc., with experienced members and knowledgeable non-members in regards to this part. Also, vote how helpful it was and what other systems might also benefit from this reading:**

**How did your research go? What ways would have optimized you're your searching (practical and dream scenario)?**

## FINAL DESIGN GUIDE

**Final Design** for will consist of **two portions**:

1. If not using a PowerPoint, a presentation that you can give as a handout (separate from the leaders' packet) to everyone to help you convey pertinent information, but please keep it limited to 3 pages.
2. A separate packet that you will hand in to the leaders and post electronically at the end of your presentation (following the guidelines below).

### **Presentation:**

- Bring 4 double-sided copies
  - o One for you to present from, three copies for the leaders
  - o **No more** than 3 pages of handouts for presentation
- Talk about your design:
  - How does your design help us succeed, i.e. what requirements does it fulfill and what are the significant interactions with other systems
  - o Specifications of your system
  - o How does your design help us succeed
    - **Points analysis (cost, weight, power vs points)**
      - Quantize the benefits vs. the drawbacks of your design in terms of the competition point system.
    - In-depth tradeoff analysis
  - o What tests have you done, what tests do you plan to do
  - o Potential failures/risks and their consequences
  - o What are the other parts that your design interacts with?
    - Describe the specifics of the interaction for each interaction.
- Risk Analysis of Risk and Opportunity the chosen design will offer (please see the two tables at the **end** of this checklist)

### **Separate Packet to turn in (use this as a checklist!!!!):**

3. Bring 2 double-sided copies for the leaders
4. Acquisition plan for EVERY component of system:
  - o Detailed, properly dimensioned CAD drawing for all manufactured parts
  - o List of parts needed and part numbers
5. Data for competition design event:
  - o Graphs
  - o Calculations
  - o Specifications
6. Manufacturing Plan
  - o **Detailed manufacturing timeline.**
  - o All processes and how much time they take (man-hours):
  - o Deadlines for each step of the process
  - o Remember that manpower will be reallocated to assist manufacturing-heavy subteams
7. Assembly Plan
  - o How will you fit the part to the final product, is the assembly order important?
  - o How will you remove the part from the final product if it needs to be serviced or replaced?
  - o All parts should be in place a few days before set team deadlines
8. Sponsorship Information
  - o Parts received and approximate value
  - o Company contact info

**Risk Analysis**

For the following Risk Analysis Please give a very **HONEST** description of where your part fits in the tables. You must provide an explanation justifying your placement within the table.

**For Risk:** If there is a high risk of your part’s failure causing us to lose competition and a high probability of this failure, please place an X in the upper right hand corner.

*Risk:*

Disaster Level	high			
	med			
	low			
		low	med	high

**For Benefit:** If there is a very significant benefit that your part has and it has a high probability of helping us win competition than place an X in the upper right hand corner.

*Benefit and Opportunity:*

Opportunity	high			
	med			
	low			
		low	med	high

# **Manufacturing Readiness Review**

## **[Date]**

Please include the following things in your manufacturing readiness review:

### **Engineering Drawings**

- Front, Top, Side, and Isometric
- Fully Dimensioned with Tolerances
  - Crucial dimensions should be labeled with the appropriate tolerances.
  - If no tolerance is given, the following will be assumed:
    - 1.234 means +/- 0.0005"
    - 1.23 means +/- 0.005"
    - 1.2 means +/- 0.05"
    - etc. . .
  - Threaded features should be labeled with thread pitch and diameter.

### **Parts Orders**

- Filled out Purchase Approval Forms (part#, cost, next cheapest price)
- If you need stock this needs to be ordered by (date)
- Means of obtaining stock if not being ordered

### **Sponsorship information**

- Contact info including name, phone, address, e-mail
- Parts donated

### **Manufacturing Timeline**

- Create personal timeline for each part or assembly with at least weekly, preferably biweekly, entries of milestones
- If parts need special treatment (anodizing, heat treat, etc.) this needs to be scheduled

<b>Parts/ Assembly</b>	<b>Date</b>

Leaders and Faculty Advisors must approve your manufacturing plan by [Date]. Feel free to submit earlier and often until your plan is approved. If questions arise regarding your part, the leaders and faculty advisors will ask you to present your information for review.

## **Logbook Entry Templates**

### **Testing Logbook Record**

*\*For every Test fill out all information*

Date and Time:  
Crew Chief/Person in Charge:  
Weather and Temperature:  
Drivers/Operators:  
Crew:  
Purpose of Test:  
Tests Conducted:  
Description of Setup Settings:  
Total Operation Time or Number of Runs:  
Results of Test:  
Location Where Results Will be Stored:  
Issues Requiring Attention:

### **Maintenance Logbook Record**

*\*For every settings change performed fill out all information*

Date and Time:  
Person(s) in Charge:  
Reason(s) for Maintenance/Setup:  
Description of Maintenance/Setup:  
Setup Settings:  
Issues Requiring Further Attention:

## **EXAMPLE OF CHECKLIST**

*This list is specific to car teams but has been included to give you an idea of the kind of checklist needed for team operations.*

### **Fluids**

- Fill gas can and spare and tank
- Engine coolant
- Torque wheels 20, 35, 50 ft lbs
- Engine oil (while running)
- Brake fluid (dot 3)
- Empty oil catch can
- Empty coolant catch can

### **Fasteners**

- 3/8" and under
- 7/16"
- 1/2"
- 9/16" and over
- SAE Allen bolts
- Engine/metric Allen bolts
- Check rubber hoses for tears
- Hose clamps
- Trailer coupler bolts

### **Miscellaneous**

- Inflate tires and air tank
  - Tires 15 psi
  - Tank 90 psi
- Attach license plate to trailer
- Call testers for testing plan
- Call Cornell police
- Start engine warm up to 200
- Check for thermostat open and fan on
- Recheck engine oil
- Bring tarp in case of rain
- Jackstand
- Bring batteries
- Charge batteries upon return**

# COMPETITION READINESS REVIEW

[DATE:           ]

The purpose of the competition readiness review is to make sure that we are prepared for competition and have planned for, or are planning, all the necessary steps to participate successfully in the competition.

## Outline:

### 11. Project Preparation

- Project testing status:
  - Discuss results from recent testing
  - Importance ranking for tests to be run in the future (list most critical first, i.e. your part could fail without testing, to least critical, i.e. it would be nice to test but it won't affect the outcome of competition)
  - Schedule future tests based on ranking system
- Preparation status of Design events and presentations:
  - Create a plan for obtaining necessary data for design and presentation events
- Check to see status of spare part manufacturing
- Create rating for each part:
  - *A: Critical* – we will lose without this part
  - *B: Important* – we could rig something and make it work, but it's not ideal and won't perform as well
  - *C: Not as important* – we can build/buy/obtain another one in the paddock in a reasonable amount of time.
  - *D: Unimportant* – it'd be nice to have, but we could run without it
- Create timeline for production of spare parts based on ratings of importance

### 12. Competition Events

- Dynamic events (If Applicable)
  - Statuses of operator readiness
  - What training is still necessary?
- Static events
  - Update on design presentation preparation, cost report presentation preparation, and business presentation preparation
  - Verify presenters have all necessary material & information
  - Prepare and print out design materials (posters, charts, etc.)
  - Practice presentations

### 13. Team Member Positions

- Assign competition roles to team members
  - Start with most important roles first (i.e. crew chiefs)

### 14. Logistics of Competition

- Preliminary assignments for:
  - Getting there drivers
  - Lodging
  - Food money person
- Create spreadsheet of team members, assigned roles, and time schedule

## Team Member Performance Review

Team Member Reviewed: \_\_\_\_\_ Reviewer: \_\_\_\_\_

Team: \_\_\_\_\_

### Participation

**Self-Actualization.** Did the team member seek out tasks and responsibilities?

unresponsive;  
required  
assignments  
and constant  
supervision

\_\_\_\_\_

1            2            3            4            5

self-starter;  
independently  
self-motivated

**Work Capacity.** Could the team member be relied upon to do his or her share of the work?

unreliable;  
others had to  
do the work

\_\_\_\_\_

1            2            3            4            5

workaholic; did  
more than what  
was expected

**Use of Time.** Did the team member make meetings on time and complete assignments on schedule?

late or absent;  
work incomplete

\_\_\_\_\_

1            2            3            4            5

prompt;  
dependably on  
time

**Team Support.** Did the team member contribute by attitude and action to team morale and group confidence?

negative;  
destructive of  
group identity

\_\_\_\_\_

1            2            3            4            5

positive;  
morale building  
feel good working  
with him/her

### General

**Of all the team, how effective was this member? How valuable was his/her contribution?**

not effective;  
contribution not  
very valuable

\_\_\_\_\_

1            2            3            4            5

very effective;  
contribution  
extremely valuable

**If you were an employer, would you hire this individual for a design team?**

no

\_\_\_\_\_

1            2            3            4            5

yes

**Hypothetically, if the project should win some monetary award to go to members, what share should this member receive?**

Much smaller  
than avg

\_\_\_\_\_

1            2            3            4            5

Much larger than avg.

**What constructive comments should be made to this team member regarding behavior that contributed to his/her strengths and weaknesses as a leader? (Use the other side)**

## Competition Roles

### **1. Crew Chief**

Responsibilities: Generally in charge of the team and all activities during his shift. Makes sure that the proper people are available and present at the proper times to fix and maintain the car. Assigns pit crew to the car during dynamic events.

Qualifications: Junior, preferably current crew chief, potential leader next year, responsible, good under pressure.

### **2. Team Mom/Dad**

Responsibilities: Waking people up, keeping track of the schedule, making sure people know where and when to go, making sure drivers/presenters sleep

Qualifications: Responsible, get along well with people, and capable of keeping track of schedule and people

### **3. Team “Bullets”**

Responsibilities: Acquiring necessary materials (i.e. paper, printer toner, food) for the team

Qualifications: Familiarity with the area of the competition, has a car (or can borrow one from another team member), driver’s license

### **4. Tool Persons**

Responsibilities: Responsible for handing out tools, keeps track of tools, makes sure tools are returned, keeping tools organized

Qualifications: Familiarity with tools, responsible, able to keep track of things

### **5. Truck Guard**

Responsibilities: Stays with and guards truck when the car is not there, located parts in truck if needed during competition event.

Qualifications: Team member

### **6. Competition Drivers**

Responsibilities: Drive during designated competition events, get enough sleep the night before to be an effective driver

Qualifications: Fastest times in event, good driver

### **7. General Team Worker**

Responsibilities: Cleaning and polishing the car, helping to maintain the car, keeping our paddock and truck clean and neat, doing everything within your power to help us win

Qualifications: Every team member

### **8. Presentation Roles (Preparation and Presenting)**

#### **A. Cost Report**

*i. Preparation*

*ii. Presentation*

Present process descriptions, overall cost report

## **B. Design Presentation**

### *i. Preparation*

Responsibilities: Compiling design notebooks (engine and chassis)

### *ii. Presentation*

Responsibilities: Answering judges design questions

Qualifications: Current team leader, articulate

## **C. Business Presentation**

Responsibilities: Preparing presentation, giving presentation, answering judges questions

Qualifications: Chosen presenters and team leaders

## **9. Competition Preparation Logistics**

Responsibilities: Keeping track of awards deadlines, getting awards banquet tickets, doing all the scheduling of the event and the days leading up to it

## **10. “Getting There and Back” Drivers**

Responsibilities: Driving to and from competition, having enough sleep to drive safely back from competition

Qualifications: Have a car, safe driver

## **11. Truck Packing/Unpacking**

Responsibilities: Packing the truck, organizing office and lab, preparing office and lab for packing, packing up truck to return to Ithaca, unpacking truck in Ithaca

Qualifications: All team members

## **12. Information Gatherer (daytime hours only)**

Responsibilities: Speaks with other teams about their systems, learns and reports about other innovations teams have implemented, photographs and documents other teams' cars

Qualifications: Knowledge about a specific system, has camera, willing to document findings

## **13. Technical PR (daytime hours only)**

Responsibilities: Stays with the car during competition hours and answers technical questions posed by other teams

Qualifications: Knowledgeable about many of the car systems

## **14. Business PR (daytime hours only)**

Responsibilities: Speaks with passing alumni, parents, professionals about the team, sponsorship, etc.

Qualifications: Business team member, gregarious

## Team Leadership Performance Review

Team Leader Reviewed: \_\_\_\_\_ Reviewer: \_\_\_\_\_

**Team:** \_\_\_\_\_

### General

1. Preparation. Was the leader well organized to help the team to use its time and resources well?

badly  
organized;  
unprepared

\_\_\_\_\_ 1      \_\_\_\_\_ 2      \_\_\_\_\_ 3      \_\_\_\_\_ 4      \_\_\_\_\_ 5

well-organized;  
homework  
done

2. Motivation. Was the leader enthusiastic and able to communicate enthusiasm to the team?

disinterested;  
uninspiring

\_\_\_\_\_ 1      \_\_\_\_\_ 2      \_\_\_\_\_ 3      \_\_\_\_\_ 4      \_\_\_\_\_ 5

enthusiastic;  
contagious  
motivation

3. Goal Orientation. Did the leader keep the project on track?

confused;  
goals blurred

\_\_\_\_\_ 1      \_\_\_\_\_ 2      \_\_\_\_\_ 3      \_\_\_\_\_ 4      \_\_\_\_\_ 5

clear direction;  
progress direct  
and steady

4. Decisiveness. Did the leader maintain team momentum by taking charge or offering ideas?

wishy-washy;  
indecisive

\_\_\_\_\_ 1      \_\_\_\_\_ 2      \_\_\_\_\_ 3      \_\_\_\_\_ 4      \_\_\_\_\_ 5

decisive when  
necessary;  
in control

5. Impartially. Was the leader a good and impartial listener, encouraging each member of the team and seeking value in all ideas?

partial;  
peremptory

\_\_\_\_\_ 1      \_\_\_\_\_ 2      \_\_\_\_\_ 3      \_\_\_\_\_ 4      \_\_\_\_\_ 5

impartial;  
reinforcing and  
encouraging

6. Leadership by example. Was the leader's behavior a good model for responsibility and conscientiousness:

bad example;  
unreliable

1      \_\_\_\_\_ 2      \_\_\_\_\_ 3      \_\_\_\_\_ 4      \_\_\_\_\_ 5      \_\_\_\_\_

good example;  
thoroughly  
dependable

**What constructive comments should be made to this team member regarding behavior that contributed to his/her strengths and weaknesses as a leader? (Use the other side)**

# Cover Sheet for Sub-team Technical Report

Sub-team Name

Group Members and Email Addresses

Course, Semester

Faculty Advisor

Date

**Topics covered:** keyword, keyword, etc.

- Put keywords for all sections here. This is very important for searches in the database. It is better to give too much information than not enough

**Executive Summary:**

- This should contain the purpose and goals of the sub-team and a *concise* summary of the work this semester and the articles that follow.

This summary and this group cover sheet must be written by the group coordinator and handed in before all articles are actually handed in. Thus it will be clear who owes what reports. On the table of contents below just list which reports will be included.

**Table of Contents:**

Article 1.....	Author(s)
Article 2.....	Author(s)
Etc.....	

## Personal Reflections Report Template

Name

Email Address

Project Groups you worked on

**Faculty Advisor**

**Date**

**Topics covered:** keyword, keyword, etc.

- This is very important for searches in the database and for people who want a very quick idea of what is covered in your personal reflection. It is better to give too many keywords than not enough.

Introduction:

- Briefly explain the design project and *your role on the team* including what teams and projects you worked on this year

**Semester Summary:**

- Summarize all the work you did year, including organization, design work, manufacture, and development.
- This should be non-technical.
- Remember be honest, you are not going to be graded on how good your paper makes the work you did this semester look.

**Post Competition Thoughts:**

- How did the team perform at the competition? Did we work together?
- Describe what you learned by looking at other teams' projects, talking to students from other teams, judges, alumni, and/or industry representatives.

**Comments and Recommendations:**

- Comment on how you feel things went this year. Things you did and didn't like.
- What can you suggest to improve the organization of the team for next year?
- If you were a team leader next year what would you do differently?

**Reflections:**

- Describe some particularly useful thing you learned this term and how you learned it. Describe any team dynamics and relationships that helped/hindered your team experience and

- make suggestions on how this can be improved in future years.
- What did you learn that you can pass on to future years' teams?
- Rank the usefulness of the following resources to your learning on the team in general (rank at least the five most important: 1 = most important. etc.)
  - \_\_\_\_\_ Looking at previous years' projects and parts
  - \_\_\_\_\_ Asking former team members
  - \_\_\_\_\_ Asking existing, more experienced team members
  - \_\_\_\_\_ Asking existing, less experienced team members
  - \_\_\_\_\_ Asking a faculty advisor
  - \_\_\_\_\_ Informal team meetings
  - \_\_\_\_\_ Formal team meetings and mini-lectures
  - \_\_\_\_\_ Manufacturers literature
  - \_\_\_\_\_ Books
  - \_\_\_\_\_ Technical papers
  - \_\_\_\_\_ Past reports (paper copies)
  - \_\_\_\_\_ Past reports (electronic copies)
  - \_\_\_\_\_ Other - please indicate what \_\_\_\_\_

**Annotated Bibliography:**

- *List the relevant complete references (books, papers, previous reports, industry contacts, alumni info, etc.) and add a sentence or two after each reference telling your opinion of it and what parts you recommend/do not recommend to future team members.*

Note that all pertinent technical references and contacts should be in the sub-team technical reports. This personal report bibliography is for general contact info (such as helpful team alums), management/organizational references, and general purpose books.

**Books:**

Gere, James M. *Mechanics of Materials*. Pacific Grove. Brooks/Cole, 2001.

This book is not as good as Machine design but I bought it for 202 so it was around my room and easy to find. This is where I took the moment area method from so it might be the best source for reviewing my work/checking for errors.

Dixon, John C. *Tires Suspension and Handling*. London. SAE International, 1996.

I have not read this book in its entirety but I have read some of the sections pertaining to tires and anti-roll. It is a good source of general data much like Race Car Vehicle Dynamics, but not quite as good in my opinion.

Milliken, William F and Douglas L. *Race Car Vehicle Dynamics*. Warrendale. SAE

International. 1995. This is the best general purpose book for the Formula SAE team member. Though not all the topics are covered in great depth it does a pretty good job of laying out the basics and has a good collection of formulas.

Norton, Robert L. *Machine Design*. Toronto. Prentice-Hall Inc, 1996.

This is a very good book. I learned all about stress, strain, and deflection by reading this

book before I had it in 202 and a large portion of what I learned wasn't covered in the class

**Team reports:**

Nick Kruczynski's 2002 Anti-Roll report- this is the better of the two reports, I though it was very good when I first read it, but working on the designing the anti-roll for a semester it seems barely adequate, it does have a good history of the anti-roll successes and failures on the cars previous to 2002.

Erik Carleson's 2003 Anti-roll report- you need to read this report for the sake of keeping a knowledge of the anti-roll design history, but don't expect to learn any great unknown theory or insights

**Websites**

Parker O-Rings, [www.parker.com](http://www.parker.com)

Parker is a major manufacturer of o-rings. You cannot purchase o-rings directly, but as a manufacturer, they provide a high level of information on o-rings for application and material selection. In particular, the charts on o-ring selection are very helpful. Some excerpts have been included with the hard copy, but the pdf can be accessed at [www.parker.com/o-ring/Literature/09-5700.pdf](http://www.parker.com/o-ring/Literature/09-5700.pdf)

efunda.com, [www.efunda.com/DesignStandards/oring/oring\\_intro.cfm](http://www.efunda.com/DesignStandards/oring/oring_intro.cfm)

Website has comprehensive background on computing o-ring specifications, groove dimensions, chemical resistance, stretch and squish. Best collection of calculations available.

**SAE Papers:**

Lawrence Technological University FSAE, SAE Technical Paper

Series 2002-01-0457, Badih A. Jawad, Jeffrey P. Hoste, and Brian E. Johnson

This paper details the team's development of a dual plenum to vary the plenum size based on the RPM range. It was developed for their 2001 car. They were able to slightly improve power and torque by controlling valves between the plenums. While the design work is not overly useful, the appendix includes a number of calculations for Helmholtz tuning. These equations were used to create a spreadsheet for optimization of plenum size and runner length.

# FINAL REPORT GUIDELINES

## Subteam Articles: Due [Time, Date]

- Deliver a paper copy to [faculty advisor, office number]
- Email to \_\_\_\_\_ or save electronically in \_\_\_\_\_

### **Format:**

The spring semester report should be a culmination of an entire year's work. Each subteam should have only **ONE** report for the entire year made up of a summary, table of contents and articles. *Open up your fall report articles, change the date and start adding information... don't write a completely new article!*

The article should include everything people need to know about your system/subteam. This includes (but is not limited to) the items listed below. Items with a star (\*) are information that should have been included in your fall report. These starred (\*) sections should be updated, corrected, and/or expanded but NOT deleted (even if the design totally changed).

### Introduction

- Brief explanation of system function and major components\*
- Summary of system design\*

### Design

- All designs you considered at the beginning of the year\*
- Specific information on the design you chose and why you chose it\*

### Manufacturing

- Details on manufacturing all parts
- Supplier information\*
- Manufacturing Steps\*
- Problems encountered while manufacturing

### Development

- What didn't work? What didn't fit? Etc. Explain anything that was redesigned
- Include tests conducted and analysis of data collected
- Explain all failures and what you did to prevent it from happening again

### Competition

- Describe how your system performed at the competition
- Include any questions that judges asked and things they liked and didn't like
- Describe any great design ideas you have from looking at other team's projects, talking to other schools, etc.

### Conclusions

- If you could do it again... what would you do different or change in next year's design?
- Appendices: Include drawings, graphs, spreadsheets, calculations
- References: Include all contact and supplier info; useful websites, books, and team reports

And last... All clarifications requested and questions raised in the fall reports should be addressed

If you wrote a good report in a previous term you should have less work to do this term. Write the report you wish you had read when you started on this part/assembly.