

Critical Function Prototype Assignment

MECH 457

Introduction, Learning Objectives:

The main goal of the Critical Function Prototype (CFP) is to allow you to develop an in-depth understanding of ONE key aspect of the system you are designing and building. This learning comes from the identification, design, building and testing of a prototype that is expressly *not* of the whole system. Rather, the prototype is of one subsystem that is responsible for a critical function that your whole design must accomplish if it is to be viable. Building the prototype will help you uncover some issues that you may not be anticipating and that may not be discoverable through benchmarking, modelling or analysis.

To be effective, the prototype should teach you about the function in question through quantitative testing (i.e., plan to make measurements from your CFP). The prototype may end up being part of the final prototype, but in general it will not be used as-is. The CFP need not be built full size if it is not practical to do so. Although a physical prototype is desirable, it may not be appropriate in all cases. Consult with your advisor for guidance. One question the CFP could answer is, for example, “Will this concept actually work?”, if two or more are top contenders and analysis alone will not answer the question. This exercise will also include a test to show, quantitatively, how well the prototype can perform its intended function. If there are limitations, this is an opportunity to use the results and map further steps.

The deliverables for the CFP Report are:

- a clear identification of the **function** that is being prototyped, the importance of the function to the project and the insights expected
- a 3-D **rendering** (solid model) of the subsystem in question
- documentation of the **prototype** (photos, video, etc.)
- a written copy of the **test** protocol with photos or simple diagrams showing the set-up
- a quantitative **analysis** of the results and a discussion of possible errors, assumptions and resultant limitations of the analysis
- a discussion on **future** steps along with an updated project schedule.

Some additional comments:

- The prototype itself will be demonstrated in the weekly meeting with the faculty supervisor following the due date of the report.
- It is not expected that the report include a set of complete engineering drawings or a bill of materials. You should, however, provide a record of critical dimensions and parameters if the values are critical to the function of the device. The most important item is the learning from the experience of designing, manufacturing and testing the prototype.
- The project budget should be used to buy parts and special materials needed for the prototype. This should be a small expenditure. Elements not critical to the function to be demonstrated should be made of at-hand, scrap materials if possible. Keep in mind that you have full access to the ME457 design studio assembly area, bookable time in the machine shop, and, in some cases, use of rapid prototyping machines.
- This assignment is as much about process as about outcome: it will let you experience all the steps that will be required for the final prototype in March: design, drawing, acquiring engineered parts, acquiring materials, machining, assembly and testing.