

## **Project 1, Take 2: The Improved Astronaut's Coat Rack**

24-370 Engineering Design I, Spring 2011

Assigned 9 February, Parts and Report Addendum due Wednesday 16 February \*at beginning of class\*

### **Overview:**

The three i's of design are: iteration, iteration, and iteration. So let's do it again! For the second portion of Project 1, you will design a revised bracket using what you learned during the first test day. Parts will be tested in class. You will also provide a short addendum to your report explaining your decisions. Please read these instructions before performing your redesign, as some things have changed. If your part or report left something to be desired, there are also opportunities for bonus points. Once again, the designer whose component meets all requirements with minimum mass will win a prize!

### **Astronaut's Helmet Bracket, Rev 2:**

Revise your bracket design using all the new knowledge you gained during the first testing day. Think about the analyses you performed and whether your models captured the important effects. Did you make any simple mistakes? Was your Free Body Diagram useful for understanding how design choices would impact strength and mass of your part? Were there important factors that were not modeled, but should have been? Did you overcompensate for issues you imagined might be important, but turned out not to be? Also think about details that might be hard to capture directly in either your simple or numerical models, e.g. affects of the manufacturing process or imprecision in load application hardware. If your design was light but failed, you might shore up areas that relate to the failure mode (while removing unnecessary mass elsewhere). If your bracket took the load but was relatively heavy, you might try removing more material in areas that seem overbuilt. If your design was far from optimal, you might try a qualitatively different design (redesign) based on shapes that looked good to you on testing day. Remember that, as Picasso is said to have said, good artists borrow and great artists steal (while staying within the bounds of academic integrity, of course). Also remember that at least one of your revisions should meet all the performance criteria. If you are struggling with your design, try to use the sketching, simple modeling, and SolidWorks refinement approach we have discussed in class, starting with a sound qualitative design.

### **Revised Part Requirements:**

With all this new information, the part design constraints and performance requirements have now changed:

1. Maximum part mass: 7.5 grams - Now that you've seen some strong designs, and found the weak parts too, you should be able to achieve a modest decrease in mass
2. No pockets - With our limited manufacturing capabilities, the pocketing process resulted in more bad effects than good ones. We will now operate in a slightly more constrained geometric environment.
3. Parts due on time, for real - Please submit your revised part using the same format as in the first version, prior to the start of class. Unfortunately, we will not be able to accept late parts for the second version due to time constraints on the manufacturing process.

## Report Addendum:

Submit an addendum to your project report that presents your revised design, as well as the reasoning behind the changes you have made. The report should contain the following:

1. Cover page: please place the following items on a single side of a single page
  - a. Title line: Project 1, the date, and Your Name
  - b. Isometric screen shots of **both** your original and revised designs, side by side
  - c. Reasoning: 200 words or fewer explaining what changes you made and why
  - d. Your estimate of the safety factor for this part
  - e. Your prediction of failure mode and location, in 15 words or fewer
2. Revised Free Body Diagrams
  - a. A free body diagram of your entire part with vector arrows showing the magnitude and direction of each force acting on the part
  - b. A free body diagram of the cross-section of any holes that are loaded by a pin or peg
3. Bonus material (extra points for good stuff)
  - a. Conceptual Design Sketches (see main project description)
  - b. Simple Modeling of Candidate Designs (see main project description)
  - c. Detailed Model and Analysis of Final Design (see main project description)
  - d. Manufacturing Report (see main project description)