

Prototype Component Upgrade

Difficulty Intermediate	Time 2-3 class periods	Type Aerospace Mission
-----------------------------------	----------------------------------	----------------------------------

Background

Fit testing has revealed one rocket component that is difficult to assemble, weak, or unreliable.

Engineering Problem

Redesign, print, and compare one component so the revised prototype performs better in a defined test.

Learning Objectives

- Translate test evidence into design changes
- Revise a parametric part
- Plan a fair comparison
- Document prototype improvement

Materials

- Original component and CAD file
- Fusion 360
- 3D printer
- Calipers
- Test materials appropriate to the component
- Engineering notebook

Procedure

1. Select one component and define the specific problem using evidence.
2. Choose one measurable performance indicator such as insertion force, alignment error, mass, deflection, or assembly time.
3. Record baseline measurements for the original component.
4. Sketch two redesign options and select one.
5. Revise the CAD while preserving required interfaces.
6. Print the revised component with recorded settings.
7. Run the same test on the original and revised versions.
8. Decide whether the revision should be accepted, modified, or rejected.

Engineering Requirements

- Define one measurable improvement target
- Preserve all required interface dimensions
- Change only features connected to the identified problem
- Use the same test method for both versions
- Document print settings and revision

Constraints & Safety

- One component only unless approved
- Use classroom-approved materials and test loads
- Do not claim improvement without comparative evidence

Deliverables

- Problem statement and baseline data
- Two concept sketches
- Revised CAD and STL
- Original/revised photographs
- Comparison data
- Revision decision and justification

Reflection Questions

1. Did the redesign meet the target?
2. What unintended effect appeared?
3. Was the test sensitive enough to show a difference?
4. What would be changed in Revision B?

Engineering Tip

Define the test and success target before redesigning. Otherwise, it is easy to declare any result an improvement.

Common Mistake

Do not change several unrelated features at once; you may not know which change caused the result.

Stretch Goal

Reduce mass or print time while preserving the performance improvement.

Career Connection

Prototype and test engineers use controlled comparisons to verify that design changes solve the intended problem.