

Simplify the Rocket Assembly

Difficulty Advanced	Time 2 class periods	Type Engineering Challenge
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Background

The current rocket assembly works, but technicians report too many parts, repeated fasteners, and slow assembly.

Engineering Problem

Redesign the assembly to reduce part count or assembly time while preserving required function and overall envelope.

Learning Objectives

- Analyze assembly complexity
- Apply design for assembly principles
- Preserve interfaces and motion
- Compare original and revised assemblies

Materials

- Existing rocket assembly CAD
- Fusion 360
- Bill of materials
- Stopwatch or assembly-time estimate sheet
- Engineering notebook

Procedure

1. Create a baseline BOM and count unique parts, total parts, fasteners, and assembly steps.
2. Identify three assembly pain points.
3. Generate two redesign concepts that combine parts, replace fasteners, improve alignment, or reduce orientation errors.
4. Use a decision matrix to select a redesign.
5. Modify the CAD assembly and update joints or constraints.
6. Create an updated BOM and assembly sequence.
7. Compare predicted assembly time and part count.
8. Check for new manufacturing, repair, or tolerance problems.

Engineering Requirements

- Reduce total part count or assembly steps by at least 20%
- Preserve rocket exterior envelope and required interfaces
- Maintain access to parts that may require replacement
- Use realistic manufacturing methods
- Update the assembly and BOM completely

Constraints & Safety

- No change may interfere with the provided rocket requirements

- Use only available manufacturing processes
- Do not hide separate components by merely grouping them in CAD

Deliverables

- Baseline BOM and sequence
- Three identified pain points
- Two concept sketches
- Decision matrix
- Revised assembly file
- Updated BOM
- Before/after comparison

Reflection Questions

1. Which assembly step created the greatest difficulty?
2. How did your redesign affect repairability?
3. What tolerance issue could appear in the combined part?
4. What physical test should verify the change?

Engineering Tip

Every time a technician must pick up, orient, or fasten a part is an opportunity for simplification.

Common Mistake

Combining parts can make manufacturing harder or prevent repair. Evaluate the full life cycle.

Stretch Goal

Create a mistake-proof feature that prevents one part from being installed backward.

Career Connection

Design-for-assembly engineers reduce part count, handling, fastening, and orientation errors to improve production.