

Redesign the Rocket Launch Pad

Difficulty Intermediate	Time 2 class periods	Type Engineering Challenge
-----------------------------------	--------------------------------	--------------------------------------

Background

Your original launch pad proved that a free-standing structure can support the classroom rocket. A launch systems team now wants a lighter, easier-to-build version that still protects and supports the vehicle.

Engineering Problem

Redesign the launch pad to use less material while maintaining stability, rocket fit, and safe classroom handling.

Learning Objectives

- Apply criteria and constraints to a redesign
- Generate and compare multiple concepts
- Collect stability test evidence
- Justify a final design using data

Materials

- Original launch pad or drawings
- Provided 3D printed rocket
- Approved classroom build materials
- Ruler or tape measure
- Scale if available
- Engineering notebook

Procedure

1. Review the original design and list three specific weaknesses.
2. Measure and record the original mass, footprint, and rocket contact points.
3. Create two new annotated concept sketches. Each concept must show how the rocket is supported.
4. Use a decision matrix with at least four criteria to select a concept.
5. Build the selected concept using fewer materials than the original.
6. Test the pad on a level surface and on a 5-degree inclined surface.
7. Place the rocket on the pad and perform three gentle disturbance tests from different directions.
8. Record results, revise one feature, and repeat the test.

Engineering Requirements

- Support the provided rocket without assistance
- Stand on its own for at least 60 seconds
- Remain upright during three disturbance tests
- Use at least 20% less material by mass or measured quantity
- Include at least one research-informed launch pad feature

Constraints & Safety

- Use only approved classroom materials
- No adhesives or fasteners may contact the rocket body
- Must fit within a 30 cm by 30 cm footprint
- Must be completed within two class periods

Deliverables

- Problem statement and criteria/constraints
- Two annotated concept sketches
- Decision matrix
- Before-and-after material comparison
- Test table with at least six trials
- Photo of final prototype
- One-paragraph design justification

Reflection Questions

1. Which criterion had the greatest influence on your final design?
2. What failed or moved during testing?
3. What tradeoff did you make between mass and stability?
4. What would you test next if the pad were used outdoors?

Engineering Tip

Move material away from low-stress areas and keep support members near the rocket contact points.

Common Mistake

Reducing material everywhere usually weakens the base. Remove material strategically instead of simply making every part smaller.

Stretch Goal

Reduce material use by 35% while keeping the same test performance.

Career Connection

Aerospace ground-support engineers design stands, fixtures, and launch equipment that protect vehicles before flight.