Unit 1 Project Brief

VEX Aerospace Mechanisms Challenge

Mechanisms of Flight: Energy, Power & Aerospace Machines

Challenge Statement: Design and test a VEX mechanism that performs an aerospace support task by redirecting energy and motion in a measurable way.

Project Overview

In this project, your team uses VEX parts to design a mechanism that changes force, speed, direction, distance, or motion for an aerospace support task. Your final design must be supported by calculations, prototype evidence, and repeatable test data.

Mission Scenario

Aerospace missions depend on mechanisms: launch support equipment, hatch doors, payload lifts, landing gear, antenna positioners, and deployment systems all use moving parts to transfer energy. Your team will create a VEX-based mechanism that performs one of these support functions and prove its performance with data.

Design Requirements

- Select an approved mission task such as payload lift, launch angle adjuster, deployable support, hatch/bay door, antenna or sensor positioner, or another approved aerospace mechanism.
- Use at least one mechanism type such as gears, pulleys, sprockets, levers, linkages, wheels, axles, or compound machines.
- Identify input motion, output motion, and how the mechanism changes force, speed, distance, direction, or torque.
- Calculate relevant values such as mechanical advantage, drive ratio, work, power, or efficiency.
- Build a stable VEX prototype with appropriate spacing, shaft support, alignment, and fastening.
- Run multiple trials and use data to judge performance and reliability.

Constraints

- Prototype must be primarily built from VEX parts and approved classroom materials.
- Mechanism must complete a measurable motion or load task.
- Design must be safe to operate and must not launch objects toward people or unsafe areas.
- Teams must document at least two design concepts before selecting one.
- Final presentation must include calculations and test data, not just a demonstration.

Required Engineering Evidence

Evidence Type	What to Include
Design Brief	Problem statement, mission task, criteria, constraints, and final performance goal.
Concept Development	Individual/team sketches, decision matrix, and selected mechanism rationale.
Calculations	Mechanical advantage, gear/drive ratio, work, power, efficiency, or other relevant values.
Testing	Repeated trials measuring load, distance, angle, time, success rate, reliability, or efficiency.

Design Review	Prototype photos, test data, final claim, evidence, and improvement recommendation.

Project Checkpoints

1. Design brief interpreted
2. Concepts and decision matrix complete
3. Prototype build approved
4. Testing data collected
5. Final design review delivered

Success Criteria

Category	Evidence of Success
Mechanism Function	Design performs the selected aerospace task in a measurable and repeatable way.
Engineering Analysis	Calculations correctly connect mechanism design to performance.
Build Quality	Prototype is stable, aligned, safe, and intentionally constructed.
Evidence-Based Defense	Final recommendation is supported by sketches, calculations, test data, and reflection.

Final Submission

Submit a complete design package that includes your notebook evidence, sketches or CAD evidence, prototype/build evidence, test data, calculations or analysis, and a final design review presentation. Your final recommendation should clearly explain what your design does, how well it performs, and what should be improved next.