Elevators

Jackscrew Elevator

- Screw provides mechanical advantage
- Ramps (screw's threads) provide mechanical advantage
  - Translate ramp a long distance with a small force
  - Ramp moves up a small distance with a large force

Jackscrew Elevator Problems

- Sliding friction
  - heat
  - wear
- Need a long screw

Hydraulic Elevator

- Pressure provides mechanical advantage

  force = pressure x surface area

  small force / small area = large force / large area

Hydraulic Elevator Problems

- Doesn't store energy between trips
  - going up, pump provides energy
  - going down, gravitation potential energy is converted to heat
- Needs a long piston

Cable Lift Elevator

- Pull from above with a long cable

Tug-of-War

Each team pulls on a rope with a force of 500 pounds in opposite directions. What is the tension in the rope?

- 500 pounds
- 1000 pounds

Tension

- Each portion of rope pulls on neighboring portions with a certain force
  - tension = force exerted on each end of rope

Pulleys

- Redirect forces
  - amount of force provided by tension
  - direction of force along rope

Multiple Pulleys

- Mechanical advantage
  - same tension in every rope segment
  - each segment pulls up with a force equal to this tension
- Small force over a long distance provides large force over a small distance

Counterweights

- Balanced seesaw
- Total mass rising or falling is small
- Requires less power to move