

# JUMPING MECHANISM

## POWER REQUIREMENTS:

Propelling a 2.4-kilogram robot into the air requires significant energy to be released in a short time period. The supplied 3-Watt motors do not produce power sufficient to directly propel the robot. However, the motors may be used to store energy in a spring over time. This energy can be released instantaneously, satisfying the power requirements.

## JUMPING HEIGHT:

The potential mechanical energy stored in the spring is first converted to kinetic energy when the robot jumps. When the robot reaches its apogee, the energy is all converted to gravitational potential energy. Therefore, the jumping height may be predicted as follows:

$$E_{spring} = \frac{1}{2}kx^2, E_{potential} = mgh, E_{spring} = E_{potential} \Rightarrow h = \frac{kx^2}{2mg}$$

Where: k = spring constant  
x = spring compression  
g = gravitational constant

## ENERGY LOSSES:

Energy is lost due to air resistance and deflection of materials during impact. To minimize energy lost to material deflection, the robot was designed with most its mass attached to the outer cylinder.

- The outer cylinder is pulled down by the powertrain to compress internal spring.
- To jump, the latch releases the cylinder.
- The cylinder then slides up the shaft and propels the whole robot in the direction of the shaft when the cylinder impacts the end of the shaft.

