**Vernier Labquest Extension / Replacement Investigation**

 **Grade** 7 **kit**: FOSS Force and Motion  **#2A**

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**Title of Investigation**: Force Speed and Acceleration

**Guiding questions**

If you build it, will it fly?

How could you explain ways to use a reference point to measure distance?

How does the number of winds (of the rubber band) affect the speed of the trolley?

**Summary of Activity**

Students fly rubber band-powered toys along a line to think critically about motion. They use reference points to determine the distance the trolley moved. Change of position is introduced as the definition of motion, and the conventional symbols of position, change and distance are introduced.

**Science standards**

7.1.7 transformation of energy, speed, acceleration, forces

**Equipment used (per group):**

Vernier Labquest, 2 photogate sensors, rubber bands, propellers

Consumables: index cards, straws, monofilament line, and tape

**Description of Procedures, notes**

Each group must set up two photogates in a “daisy chain” configuration with one Labquest. The distance between the two gates must be entered into the Labquest. Students will use the labquest to determine the velocity (speed) of the trolley. Each group prepares an air trolley, hooks it to a fish line guide wire, winds up the propeller and lets it go to measure the magnitude of the change. We found the straw measurement needed to be adjusted to fit properly. The fishing line included is ten pound test line and it broke, so 30 pound test line would be better. After acquiring data for different numbers of winds, students graph the results to look for a relationship. The conventional form and procedures for preparing two-coordinate graphs are introduced.

**Scientific Questions**

What are the relationships between position, time, and speed?

How does the amount of turns on the rubber band affect its speed?

What energy transformations are occurring, and how is energy used?

**Connections**

Math

X=the position of the trolley

Δ=Greek symbol for change

D=distance (Xf-Xi)

What is the connection between energy input and energy output?