Name:

Class:

GRAVITY TRACTOR

Active reading:

1. Circle the unknown vocabulary. Look up and define words in the margin.
2. Underline all proper nouns (people, place and things with names)
3. Highlight the main points (focus on what is the problem and the parts of the proposed solution)
4. Paraphrase the highlighted main points in the margin. Identify the IV, DV, K and Hypothesis for their planned experiment.

**Gravity-Powered Asteroid Tractor Proposed to Thwart Impact**

By Bjorn Carey November 9, 2005

An asteroid the size of two football fields could wipe out a large city or set off a series of tsunamis across the world. The treat of such an Earth-smashing asteroid has lead scientists to dream up several methods of defending the planet against such a catastrophe.

Solutions have ranged from pushing the asteroid with a spacecraft to mounting a thruster on its surface. But pushing it would require too much fuel and could break up the asteroid. Also, asteroids rotate, which could complicate the firing of a surface thruster.

Now, two NASA astronauts have presented a plan for an “asteroid tractor”—an unmanned, 20-ton spacecraft that uses the invisible bond of gravity to gently pull an asteroid into a new, non-threatening orbit.

“You can think of it like a big elastic band between the two pulling them together,” said Edward Lu, who presents the concept for the spacecraft with fellow astronaut Stanley Love in the Nov. 10 issue of the journal *Nature*.

The tractor would hover above the surface of the asteroid, without touching it, and use gravity as a towline. If the spacecraft maintains a consistent distance between it and the asteroid, and always tows in the same direction, this method won’t disturb the asteroid’s rotation or composition.

Despite the urge to give the asteroid a hardy tug, the key to moving an asteroid with gravity is to be gentle. An asteroid is likely to be loosely packed material, so tugging on it too hard could break it into unmanageable pieces. Or, the force from the spacecraft’s thrusters could break up the asteroid or stir up unwanted dust if fired too vigorously.

To make sure the thrusters couldn’t break up the asteroid—or hinder the net towing force by pushing the asteroid away—Lu and Love angled the thrusters slightly away from the body of the spacecraft.

“The jets fire off to the side, not quite as efficient as firing straight down. It’s like rowing forward by pushing off to the sides—it keeps you moving forward, but very slowly. It takes less than a pound of force—about what you need to hold a cup of coffee.”

In 2029, the 1,000-foot (320 meters) asteroid 99942 Apophis (2004 MN4) will whiz by Earth at a distance of about 18,600 miles (30,000 kilometers). That’s about as close as many geosynchronous satellites. It will swing by the Earth again in either 2035 or 2036, and scientists predict it has a small chance of hitting the planet on this pass.

“The kind of spacecraft we’ve talked about could move an asteroid 650 feet (200 meters) across provided we have decades of advanced warning,” Lu said. “That’s not out of line with what you’d expect – we can predict the orbit of an asteroid decades in advance.”

Response CER paragraph:

* **Claim**; Make a statement that answers the question, “How can the scientists move the asteroid without touching it?”
* **Evidence**- support your claim with quotes from the article
* **Reasoning**: explain why this will work by including information about gravity from your class notes, class activities and the article (be sure to use vocabulary!).
* **Extension**: Make suggestions on how they can use the properties of gravity to improve their plan so that it might be more successful.