1. Mark your confusion.
2. Show evidence of a close reading.
3. Write a 1+ page reflection.

NASA Is Practicing Asteroid Deflection. You Know, Just in Case.

A spacecraft is on its way to nudge a distant asteroid.

Source: Marina Koren, TheAtlantic.com, November 26, 2021

The last thing anyone needs to think about right now is a catastrophic asteroid impact.

And, thankfully, most of us don't have to! Earth is not in immediate threat of a space rock. The chance that a known asteroid big enough to really do damage—or, you know, imperil our entire existence—will strike the planet in the next 100 years is insignificant. (If you want to worry about extinction, consider the extinctions brought on by climate change and other negative repercussions of our presence here on Earth.)

But it helps to be prepared for these kinds of scenarios, and luckily there are people for whom thinking about them is a full-time job. So this week, just before Thanksgiving, NASA launched a space mission to test technology that could, someday, help humanity deflect a dangerous asteroid barreling its way.

The spacecraft will now spend months zooming toward an asteroid several hundred million miles from Earth. (What did this particular asteroid ever do to us? Nothing—but NASA needs a test subject.) In September 2022, with the asteroid in its sights, the probe will line itself up and then—*bam!*—smash right into the unsuspecting rock at nearly 15,000 miles an hour. The impact is expected to change the orbit of the asteroid ever so slightly. Afterward, scientists will observe the shift with telescopes on Earth to determine whether this technique could work to protect our planet from a real cosmic threat.

This would not be the first time a NASA spacecraft has bumped into an asteroid just minding its own business. Last year, a probe touched down on an asteroid's surface and blasted it with nitrogen gas to stir up rocks. That mission was designed to collect some of those rocks and return them to Earth so that scientists might better understand how nature shaped the solar system and gave our planet its oceans. NASA punched that asteroid for the sake of science. This new mission is about survival.

The Double Asteroid Redirection Test, or DART for short, marks humanity's first-ever attempt to change the orbit of an asteroid. In some ways, it's kind of rude? A bunch of "star stuff," as Carl Sagan called us, has become sentient and smart enough to interfere with orbital mechanics and change, on a small scale, the nature of its solar system. It's a weirdly godlike power move—you know, shifting heaven and earth for our own purposes. But here we are, throwing a spacecraft the size of a vending machine at an asteroid as big as Egypt's Great Pyramid.

The series of events that brought us to this particular point in human history can be traced back to 1998, when an astronomy institute issued an alert about a recently discovered asteroid that looked like it could hit in 2028. In astronomy time, that's basically tomorrow, so if the asteroid was indeed a threat, we needed to do something about it soon. Scientists at NASA quickly found that this rock wasn't going to collide with Earth, but the agency did establish a center devoted to estimating the probability of asteroids and comets hitting Earth, so that we might have a chance at actually stopping them.

The DART mission is aiming for Dimorphos, a half-mile-wide asteroid that orbits a bigger asteroid, Didymos, like a moon. If the mission works as intended, DART will carve a crater into the surface of Dimorphos and fling out a bunch of rocky debris, known as ejecta, explains Angela Stickle, a planetary scientist at the John Hopkins University Applied Physics Laboratory who leads the team that does impact simulations. "As that ejecta leaves the asteroid, it acts kind of like a rocket engine and pushes the asteroid," Stickle told me. "You're creating sort of a natural engine on the asteroid that then slows down its velocity." Stickle and her team predict that the impact will shrink Dimorphos's 12-hour orbit by about 10 minutes or so. A change in an object's velocity translates into a change in its orbital path; if an asteroid were heading toward Earth, a version of this technique might shift an asteroid's trajectory enough to turn a certain disaster into a near miss.

In case you, like I, a person who usually assumes the worst, are wondering whether NASA could flub this mission and accidentally shove the asteroid toward Earth—don't worry. A vending machine–size spacecraft isn't capable of knocking Dimorphos out of its orbit around Didymos, or even inflicting serious damage. "This

isn't going to destroy the asteroid," Nancy Chabot, the mission's coordination lead at the Applied Physics Laboratory, told reporters earlier this month. "It's just going to give it a small nudge."

The DART mission faces some unknowns. Astronomers think Dimorphos is probably a common kind of rocky asteroid. But asteroids have surprised them before. The asteroid that NASA touched down on last year, Bennu, turned out to be squishier than expected. And squishy asteroids would be more difficult to deflect, Cristina Thomas, a planetary scientist at Northern Arizona University who leads an observations team on DART, told me. "It's a much simpler physics experiment if you take one hard thing and you smash it into another hard thing," she said.

In 2024, another planetary-defense mission, operated by the European Space Agency, will leave Earth for Didymos and Dimorphos to survey the scene and provide a close-up look of the aftermath of humanity's attempt to mess with an asteroid. Meanwhile, on Earth, NASA will continue to search for and monitor near-Earth objects of a certain size. In 2005, Congress directed NASA to find at least 90 percent of the potentially hazardous asteroids that are statistically likely to exist out there. Remember when I said that no known asteroids have a significant chance of crashing into Earth in the next century? Well, NASA was supposed to meet that 90 percent goal as of 2020, but so far scientists have managed to find only 40 percent. Objects like Dimorphos appear fainter to telescopes than larger asteroids, which are easier to study and rule out as a hazard, Thomas said. "But an object of this size would actually pose a hazard to the planet," she told me.

Let's say that someday astronomers identify a new asteroid that, unlike the 1998 discovery, could really be perilous. Scientists have practiced this scenario every year for nearly a decade in a NASA-run event about planetary defense. This year astronomers pretended that they had discovered an asteroid with a slight probability of hitting Earth in just six months. After a month of observations in this hypothetical scenario, that likelihood jumped to 100 percent. Astronomers needed more than a year to determine where exactly a hazardous asteroid would strike Earth, and they didn't have that kind of time. Within days of impact, astronomers had only predictions about the regions at risk, including the places deemed "unsurvivable." This particular exercise ended with a bleak conclusion: With a more powerful telescope scanning the skies, astronomers would have spotted this asteroid sooner, and space agencies would have had time to mount a mission like DART to attempt to deflect it away from Earth. And that telescope would have needed to be in place back in 2014.

A starter mission such as DART is an important step in giving Earth a chance in this future. Despite what pop culture (or, more specifically, Armageddon) has led us to believe, space agencies won't rely on a group of brave oil-rig workers but on spacecraft with good GPS to save us. (NASA actually invited Bruce Willis to attend the launch in California; the actor declined.) Any nuclear weapons—another option for destroying an asteroid headed our way—would likely be delivered by autonomous spacecraft, not astronauts. A future asteroid-redirect mission might be informed by the designs of previous spacecraft that destroyed themselves in the name of planetary defense, and guided by telescopes that have kept a watchful eye on the night sky, logging every new asteroid. When it comes to Earth-threatening asteroids, to paraphrase Aerosmith, you "don't want to miss a thing."

Possible Response Questions

- What are your thoughts about the development of planetary defense? Explain.
- Did something in the article surprise you? Discuss.
- Pick a word/line/passage from the article and respond to it.
- Discuss a "move" made by the writer in this piece that you think is good/interesting. Explain.