

# To save the Earth someday, team builds spacecraft to crash into an asteroid and shove it off course

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A team of scientists, astronomers and engineers meets weekly in a conference room on a Howard County, Md., research campus and plans to save the world.

"Keep calm and carry DART," reads a poster on the wall.

DART—the Double Asteroid Redirection Test—is their plan to avert catastrophe. It's also NASA's first mission not to explore space, but to defend against it.

The research team at the Johns Hopkins University Applied Physics Laboratory in Laurel plans to launch a spacecraft, speed it up really fast and smash it into an asteroid. BOOM!

The impact, they hope, will bump the big space rock off course—actually more like nudge it slightly. Someday, the thinking goes, this method may save humans from the fate of the dinosaurs.

"Kind of like a big missile," said Elena Adams, the mission's lead engineer. "It's very exciting. You are actually doing something for the fate of humanity."

An estimated 100 tons of space debris falls to Earth every day, according to scientists with the NASA's Jet Propulsion Laboratory at the California Institute of Technology. This debris is mostly dust and sand.

Occasionally, space sends something bigger.

In February 2013, a fiery meteor cut across the Siberian sky. It came streaking down as fast as 40,000 mph. Then came a mid-air explosion, a flash and boom.

The shock wave blew out windows across the Russian city of Chelyabinsk. A factory roof collapsed. More than 1,000 people were hurt, mostly from shattered glass. Scientists estimate the meteor unleashed a force stronger than the atomic bomb detonated in Hiroshima.

The rock was about the size of a school bus. That's a pebble compared to a meteor believed to have exploded over remote Siberia in 1908, flattening hundreds of square miles of forests. Researchers estimate that fireball equaled 185 Hiroshima bombs and heated the air to near 50,000 degrees. If the Tunguska meteor had arrived, say, three hours later, it could have obliterated Moscow, said Lindley Johnson, whose title with NASA is planetary defense officer.

"That probably would have changed the entire history of the 20th Century," said Johnson, who runs NASA's asteroid-defense programs. "These are natural disasters that we need to be aware of."

Some time in a span of several hundred-thousand years, scientists say, an asteroid even larger could strike Earth and wreak global disaster. They believe a meteor 8 to 10 kilometers in diameter crashed into the Gulf of Mexico 65 million years ago and killed off the dinosaurs.

"We've found all the nearest asteroids that size. We're safe from that," said Paul Chodas, who runs an asteroid search team at the NASA lab in California.

But smaller asteroids can unleash megatons of energy too.

"Even down to the 1-kilometer size, if it hits in the right spot, could cause global devastation," Chodas said. "It's the small asteroids that pose the risk."

In the 1990s, Congress ordered NASA to locate dangerous asteroids in the solar system. Researchers today aim to catalogue the orbits of 90 percent of asteroids 460 feet or bigger.

They predict 25,000 of them hurtle through the solar system. Chodas said they have found and charted about a third of them. The researchers

can calculate each asteroid's trajectory decades into the future.

Scientists have long debated what to do if they discover one on a collision course with Earth.

Hollywood portrayed such events in "Deep Impact" and "Armageddon." In both movies, mankind narrowly escapes doom by planting nuclear bombs and blowing the asteroids to pieces.

It's not that easy.

NASA has considered nuking an asteroid with warheads, but that risks turning a single incoming rock into a shower of debris as happened in "Deep Impact." Another plan calls for flying a spacecraft beside the asteroid and gradually drawing it off course like a gravity tractor.

DART offers a third strategy, and will be the first given a live test.

"It's the simplest and most effective," Chodas said.

Now the team at the Hopkins laboratory in Laurel has begun the final design and construction of the DART spacecraft. About the size of a Honda Civic, it's scheduled for launch in summer 2021.

While it sounds simple, the crash mission involves some tricky engineering.

The target is the tiny moon of an asteroid. The two bodies are collectively named Didymos or Greek for "twin." They orbit the sun between Earth and the Asteroid Belt. The moon is not much bigger than the Washington Monument in D.C. - minuscule in the scale of space.

"This is by far the smallest object anyone has ever flown a spacecraft

into," said Andy Cheng, the mission's co-lead and chief scientist in APL's space department.

The spacecraft will be powered by solar panels that unfurl like wings. Its journey will take more than one year, and the researchers will be flying blind mostly.

"We don't see the moon of the asteroid until we're just an hour away," said Adams, the engineer. "That last hour is going to be really thrilling."

They plan for DART to reach speeds as fast as 15,000 miles per hour. The crash in October 2022 will fling debris from the asteroid moon. A small satellite will accompany the DART spacecraft to measure the effect.

The team wants to hit the asteroid moon with enough force to bump it, but not break it apart. The moon orbits the asteroid at a speed of about seven inches per second. They hope to change the speed by about a centimeter per second.

"We're just going to give it a love tap," said Andy Rivkin, the mission's other co-lead and planetary astronomer at APL.

In theory, a series of taps over time could deflect an asteroid off a course for Earth.

One impact may suffice if scientists have enough warning time. An imminent asteroid strike, however, would require multiple launches and impacts.

"You could have a constant stream," Rivkin said. "Each one nudges it a bit more."

It's humanity's best plan to save Earth, but one the team hopes they never have to use.

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