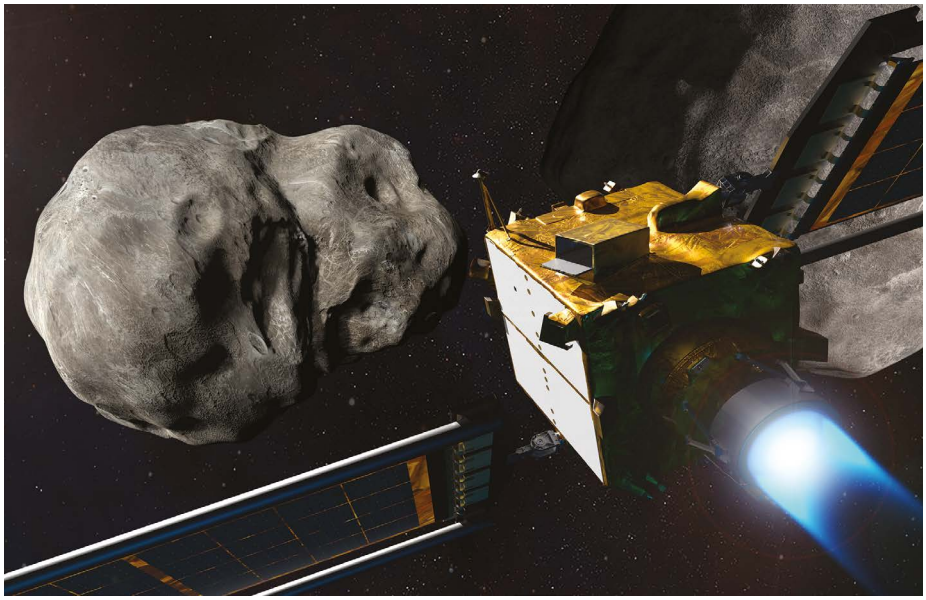


NASA/JOHNS HOPKINS UNIV. APL

The DART mission's target is the asteroid Dimorphos, as shown in this illustration.

NASA LAUNCHES FIRST PLANETARY-DEFENCE MISSION

DART spacecraft will slam into an asteroid to test a strategy for protecting Earth.

By Alexandra Witze

NASA has launched a multimillion-dollar spacecraft — to slam into an asteroid. Rather than being a catastrophic error, however, it will be the first test of a way to protect Earth from killer asteroids.

The asteroid that NASA is aiming to smash the craft into, called Dimorphos, is not a threat to Earth. But researchers want to see whether they can change its trajectory, long before they might need to use such a strategy to deflect a truly dangerous asteroid.

"The odds of something large enough to be a problem, that we would have to deflect, are pretty slim in our lifetimes," says Andy Rivkin, a planetary scientist at the Johns Hopkins University Applied Physics Laboratory (JHU-APL) in Laurel, Maryland, which built the spacecraft for NASA. "But sometimes your number comes up when you don't expect it, and it's good to have an insurance policy."

Launched from California on 23 November, the spacecraft is called the Double Asteroid Redirection Test (DART)[1]. Its target is a pair of asteroids that travel together through space, one orbiting the other as they circle the Sun (see 'A not-so-gentle nudge'). Dimorphos, the smaller of the two at 160 metres wide, orbits Didymos, which is nearly 5 times larger and is named after the Greek word for 'twin'.

In late September or early October of next year, DART is slated to slam headlong into Dimorphos at a speed of 6.6 kilometres per second. The impact should shrink Dimorphos's orbit so that the asteroid circles Didymos at least 73 seconds faster than before. (Dimorphos takes its name from the Greek for 'having two forms', to signal NASA's intent to change the asteroid's orbit.) Astronomers using telescopes on Earth will watch Didymos for signs of that orbital change — which would be evident in the way its brightness changes over time, as Dimorphos passes in front of and behind it.

This complicated choreography is meant to test the idea that smashing a spacecraft into an asteroid can give it enough of a nudge to keep it from hitting Earth, says Nancy Chabot, a planetary scientist at JHU-APL who works on the mission. Using the non-threatening pair Dimorphos and Didymos is "a really smart and a safe way to do this first test", she says. The impact will occur when the asteroids are 11 million kilometres from Earth.

Battling asteroids

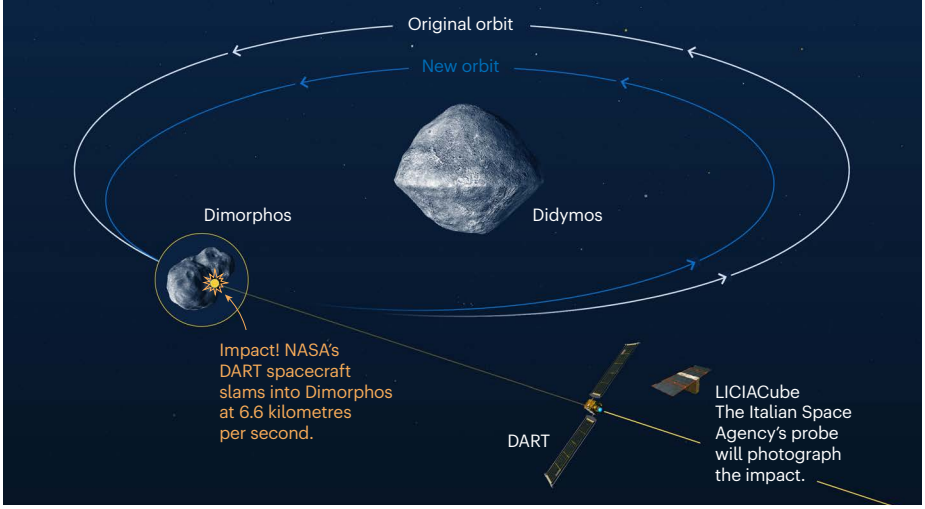
Small asteroids and asteroid fragments hit Earth all the time, but most of them disintegrate in the atmosphere or fall harmlessly to the ground as meteorites. NASA has identified more than 27,000 asteroids with trajectories that bring them close to Earth. The worry is that some new asteroid could appear, heading directly towards the planet — and that it would be large enough to have serious consequences when it hit, just as the asteroid that helped to kill off the dinosaurs and some other life on Earth 66 million years ago did.

Space scientists have floated all sorts of ideas about how to battle incoming asteroids, the most dramatic of which involves blasting them with nuclear weapons[2]. Other, less cinema-worthy strategies involve smashing a spacecraft into it, as the US$330-million DART mission will.

Depending on the angle at which DART hits the asteroid, it could kick up a small cloud of dust and rubble. The impact will probably

A NOT-SO-GENTLE NUDGE

Next year, the Double-Asteroid Redirection Test (DART) spacecraft will attempt to change the orbit of one asteroid that is circling another. Neither is a danger to Earth, but the test is a dress rehearsal for protecting the planet from future threats.



ADAPTED FROM NASA/JOHNS HOPKINS UNIV. APL

leave a crater that could be around 10 metres across. At the same time, bits of the spacecraft's wreckage might scatter across the asteroid's surface, but exactly how DART will break apart remains to be seen. "Just from a pure crime-scene sense, a lot of us are curious about that," Rivkin says.

Researchers will have a chance to get answers, because, minutes after impact, a tiny probe funded by the Italian Space Agency will fly past to photograph the aftermath[3]. Named LICIACube, it will travel aboard DART and is the agency's first autonomously guided deep-space mission. LICIACube will be released from DART 10 days before impact, and come within 55 kilometres of Dimorphos. As it whizzes past, its cameras should spot the dust cloud, if the impact kicks one up, and possibly the resulting crater. "We might be surprised by the images we collect," says Elisabetta Dotto, an astronomer at the National Institute for Astrophysics in Rome, which is leading the collaboration of Italian universities and institutions involved in LICIACube.

In 2026, a follow-up spacecraft, the European Space Agency's Hera mission, will visit Dimorphos to take more detailed pictures of the impact site.

Data collected by the DART mission should help scientists to understand how impacts affect asteroids, says Megan Bruck Syal, a physicist at the Lawrence Livermore National Laboratory in California, who will model what happens to Dimorphos. But DART is just one test involving one kind of space rock. There could be scenarios in which planetary defenders want to hit an asteroid with more speed than DART will achieve when it hits Dimorphos, or in which they need to pummel an asteroid with several impactors to change its course. "We need to do more experiments like this," Bruck Syal says.

Although many other spacecraft have been deliberately smashed into celestial objects at the ends of their lives, DART promises to be the first to hit a planetary body in the name of saving Earth.

1. Rivkin, A. S. *et al. Planet. Sci. J.* **2**, 173 (2021).
2. King, P. K. *et al. Acta Astronaut.* **188**, 367–386 (2021).
3. Dotto, E. *et al. Planet. Space Sci.* **199**, 105185 (2021).

OUTCRY AS MEN WIN BIGGER SHARE OF AUSTRALIAN GRANTS

Analysis showing women won fewer grants prompts thousands to sign a petition calling for gender quotas.

By Holly Else

Men secure a greater share of medical-research funding than women in Australia's largest grant-award programme, despite applying at similar rates, according to an analysis. The issue was flagged by researchers in 2019; however, this time, nearly 6,000 people have signed a petition calling for the introduction of gender quotas.

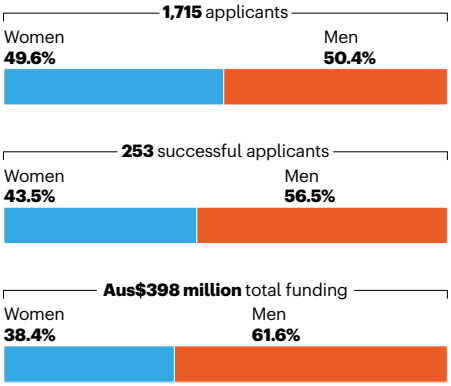
"It is soul-destroying to watch a disproportionately higher number of young, bright women stagnate or be pushed out of the system compared to their male counterparts," says Rachael Murray, a biomedical scientist at the Queensland University of Technology in Brisbane.

The findings come after the National Health and Medical Research Council (NHMRC) overhauled its funding programmes in 2018–19, attempting to take gender equity into account.

The awards in question are the NHMRC's investigator grants, comprising Australia's largest research-funding programme, which consolidates salary and project support into one flexible, five-year grant for the best researchers at various stages of their careers. Before 2019, scientists had to apply for a fellowship to fund their salary, and separate grants for their research.

MORE MONEY FOR MEN

Although the numbers of male and female applicants for the National Health and Medical Research Council's investigator grants in 2021 were comparable, men received 23% more grants than women.



The NHMRC has previously acknowledged problems with equity, and in 2018, it released a gender-strategy report. The hope was that by combining salary and research funding, the new investigator grants would allow projects to continue if their leaders needed to work part-time because of childcare or other responsibilities.

But the data from the latest round of funding in 2021, released in October, suggest that the new scheme still favours men over women.

Men won more grants and were awarded more money, according to Louise Purton, a stem-cell biologist at St Vincent's Institute of Medical Research in Melbourne, and Jessica Borger, a medical researcher at Monash University in Melbourne, who crunched the numbers and revealed the disparity in an article for Australian news site Women's Agenda (see go.nature.com/3kaj5qw).

Across the scheme, men and women applied for grants at similar rates — with 865 men applying for funding, alongside 850 women. But 143 men secured funding totalling Aus$245 million (US$176 million), compared with 110 women netting just $153 million (see 'More money for men').

Systemic disparities

The scheme offers grants at three levels of seniority. At the most junior level, women as a whole secured equal amounts of funding to men, but the distribution of grants for more established scientists was skewed heavily towards men. Only about 20% of the awards for the most experienced scientists went to women, according to the analysis.

Anne Kelso, NHMRC chief executive, agreed that there are clear gender disparities, but says that they reflect the disparities in the gender balance of the make-up of scientists at various career stages at Australia's universities.

"The single biggest contributor to the investigator grant outcomes is the predominance of male applicants at the most senior level of the scheme," she told *Nature*. At that level, for which the funds awarded are the largest, there were about four times more male than female applicants, she says.

The petition (see go.nature.com/3xqng23), created in response to Purton and Borger's analysis, says that the NHMRC "is awarding women significantly less funding than their male counterparts in a broken system", which it says "requires an urgent strategic overhaul".

It is calling for the funder to allocate the same amount of money to men and women, and to include a separate pot for non-binary applicants. It also pushes for set gender quotas for fellowships at each level of seniority.

In response to these calls, Kelso says "all options are on the table", adding that the "NHMRC schemes are under continuous review to ensure they are meeting their objectives" in terms of gender equity.

L. PURTON & J. BORGER *WOMEN'S AGENDA*, 2021.