National Aeronautics and Space Administration

# DART

NASA'S FIRST PLANETARY DEFENSE TEST MISSION

## The Double Asteroid Redirection Test (DART)

Developed and led for NASA by the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland, DART will demonstrate the planetary defense technique known as kinetic impact. The DART spacecraft will slam into an asteroid and shift its orbit, taking a critical step in demonstrating ways to protect our planet from a potentially hazardous impact.

DART's target is a binary asteroid system consisting of Didymos (Greek for "twin"), about a half-mile across, and its smaller companion called Dimorphos (Greek for "two forms"), about 530 feet across. Launching in fall 2021, DART will use an autonomous targeting system to aim itself at Dimorphos. The spacecraft, roughly the size of a small car, will strike the smaller body at about 4 miles per second. Telescopes on Earth will observe the asteroid system and measure the change in Dimorphos' orbit around Didymos. A ride-along CubeSat named LICIACube, built by the Italian Space Agency, will separate from DART before impact to observe the collision.

### Planetary Defense

On February 15, 2013, a meteor exploded over Chelyabinsk, Russia, creating an airburst and shockwave that struck six cities across the country — and sending a stark reminder that dangerous objects can enter Earth's atmosphere at any time. Astronomers estimate there are tens of thousands of near-Earth asteroids close to 500 feet wide and larger, big enough to cause regional devastation if they actually hit Earth. The Chelyabinsk object was just about 60 feet wide, demonstrating that even small asteroids can be of concern — and making real-world tests of space-based planetary defense systems all the more important.

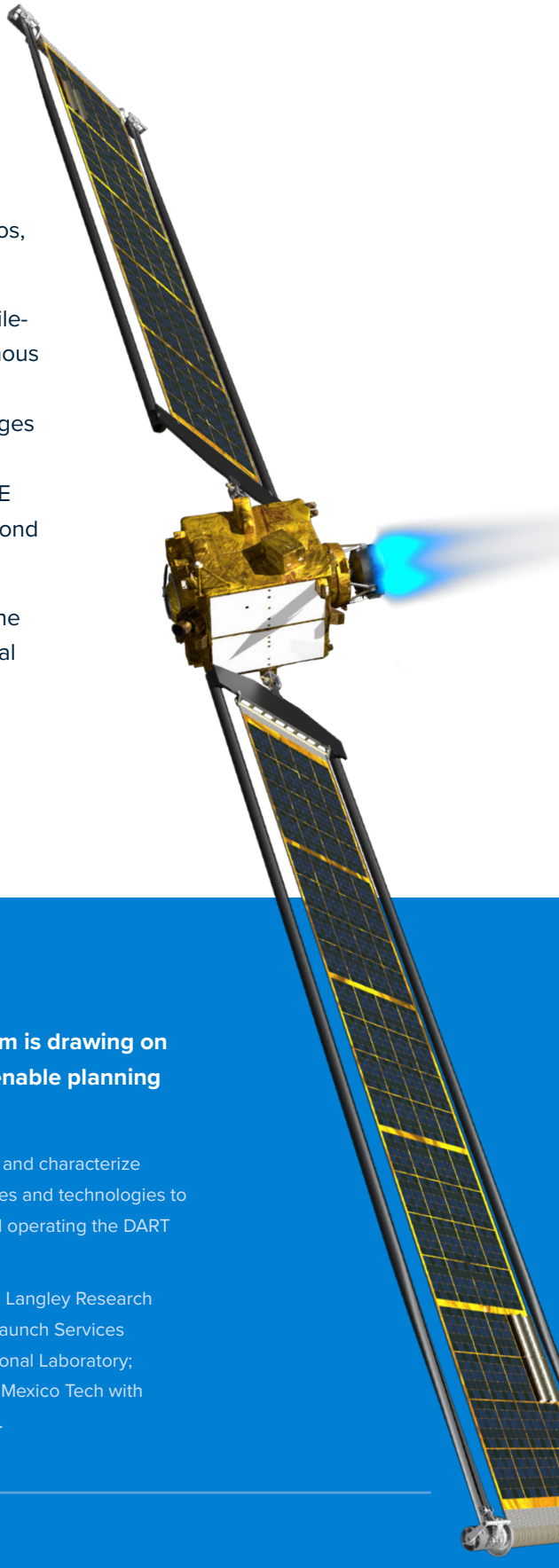
APL JOHNS HOPKINS APPLIED PHYSICS LABORATORY

# The Spacecraft

APL is building DART and the spacecraft's single instrument, the Didymos Reconnaissance and Asteroid Camera for Optical navigation. Known as DRACO, the camera will not only capture images of Didymos and Dimorphos, but also support autonomous optical navigation for the DART spacecraft.

DART incorporates several new technologies. Leveraging decades of missile-guidance expertise, APL developed the Small-body Maneuvering Autonomous Real-Time Navigation (SMART Nav) algorithms to autonomously direct the spacecraft toward its target. In DART's final hours, SMART Nav will use images from DRACO to identify and distinguish between Dimorphos and Didymos. SMART Nav will run on an innovative APL-developed firmware-based CORE Small Avionics suiTe (CORESAT) computer, streaming images once per second back to Earth through a novel Radial Line Slot Array high-gain antenna.

DART will fly Deployable Space Systems Roll-Out Solar Arrays (ROSA) for the first time in deep space, featuring powerful APL-developed Transformational Solar Array concentrators. The arrays will power NASA's Evolutionary Xenon Thruster—Commercial (NEXT–C) ion engine, an electric propulsion system developed by Glenn Research Center in collaboration with Aerojet Rocketdyne. The DART mission will demonstrate this new technology and mature it for future missions.



# The Team

**Planetary defense is an international concern; that's why the DART team is drawing on expertise from around the world to evaluate the mission's results and enable planning for future planetary defense efforts.**

NASA's Planetary Defense Coordination Office supervises NASA-sponsored projects to find and characterize asteroids and comets that pass near Earth's orbit and coordinates development of techniques and technologies to respond to an identified impact threat. In addition to managing the mission and building and operating the DART spacecraft, APL is also coordinating the investigation team.

U.S. partner institutions include NASA Goddard Space Flight Center, Johnson Space Center, Langley Research Center, Glenn Research Center, Marshall Space Flight Center, Kennedy Space Center, and Launch Services Program; Jet Propulsion Laboratory; SpaceX; Aerojet Rocketdyne; Lawrence Livermore National Laboratory; Auburn University; University of Colorado; Lowell Observatory; University of Maryland; New Mexico Tech with Magdalena Ridge Observatory; Northern Arizona University; and Planetary Science Institute.

For more information about DART, visit:

nasa.gov/planetarydefense/dart
dart.jhuapl.edu

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