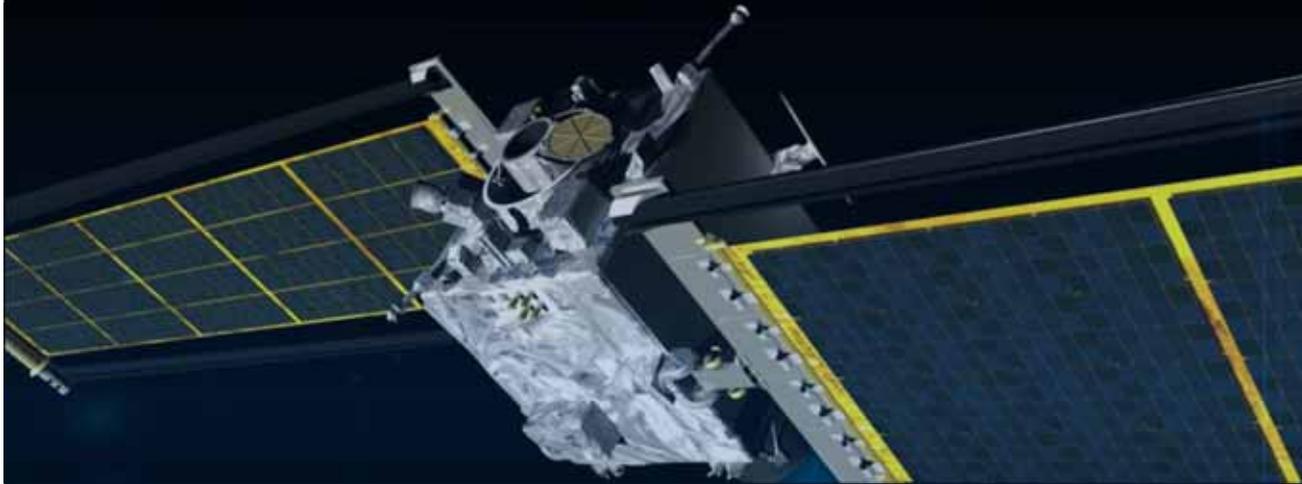




Kinetic Impactor



Andy Cheng
JHU/APL
15 Nov 2018

DART Mission Update

Goddard Space Flight Center
Johnson Space Center
Langley Research Center
Glenn Research Center
Marshall Space Flight Center
Planetary Defense Coordination Office



Jet Propulsion Laboratory
California Institute of Technology



University of Colorado
Boulder

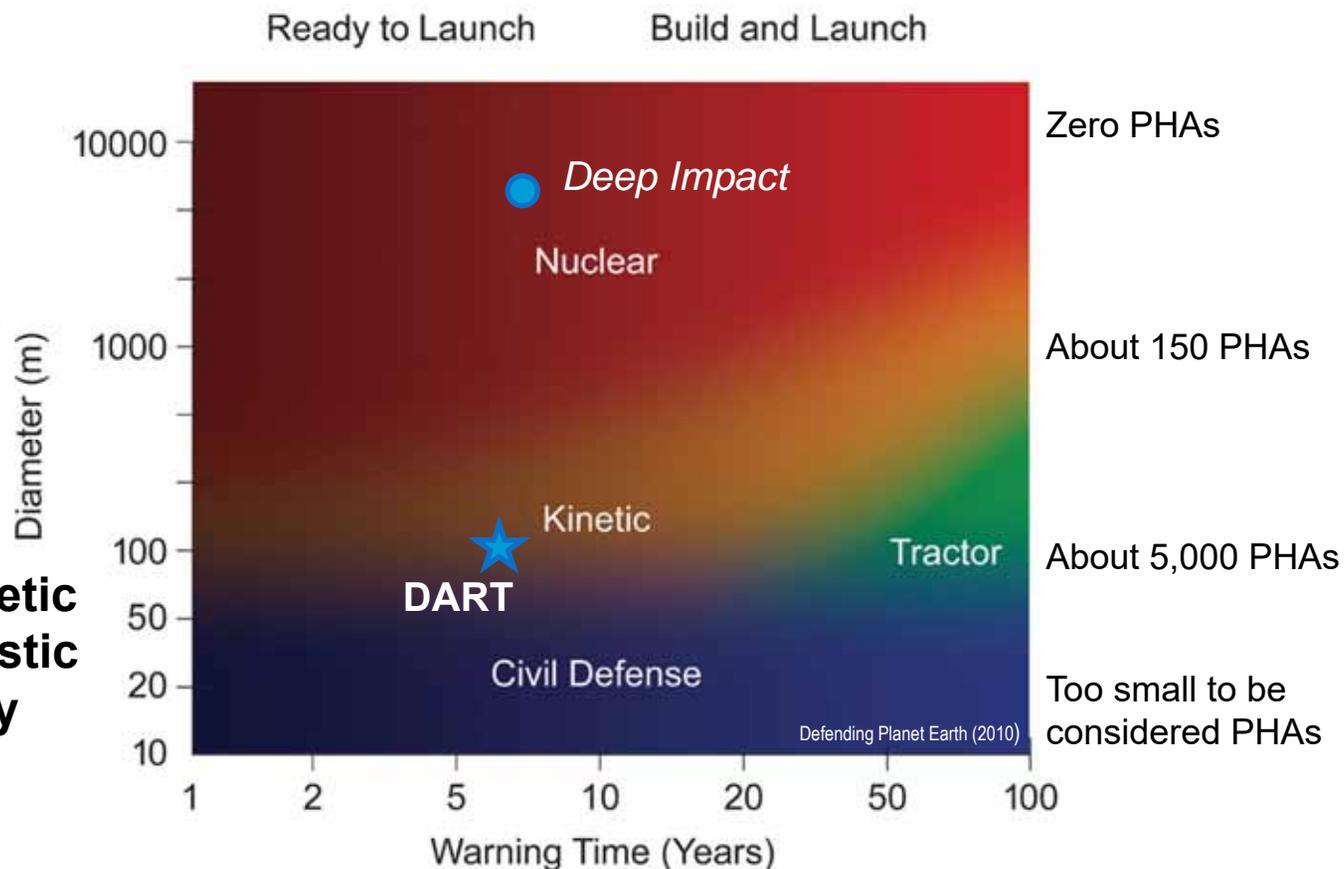


Regimes of Primary Applicability for Planetary Defense Mitigation

**Defending Planet Earth
(2010)
National Academy of
Sciences**

Recommendation:
“the first priority for a space
mission in the mitigation
area is an experimental
test of a kinetic impactor”

**DART is the first kinetic
impact test at a realistic
scale for planetary
defense**



Launch

June 15, 2021



March 6, 2022
2001 CB21 flyby
S-type, 578 meters,
3.3-hour rotation rate

LICIA
(Light Italian Cubesat
for Imaging of Asteroids)
ASI contribution, under
consideration

IMPACT: October 5, 2022

DART Spacecraft

560 kg arrival mass
12.5 m × 2.4 m × 2.0 m
6 km/s closing speed

Didymos-B

163 meters
11.92-hour orbital period

65803 Didymos (1996 GT)

1,180-meter separation
between centers of A and B

Didymos-A

780 meters, S-type
2.26-hour rotation period

Earth-Based Observations

0.07 AU range at impact
Predicted ~8-minute change
in binary orbit period

- Target the binary asteroid Didymos system
- Impact Didymos-B and change its orbital period
- Measure the period change from Earth





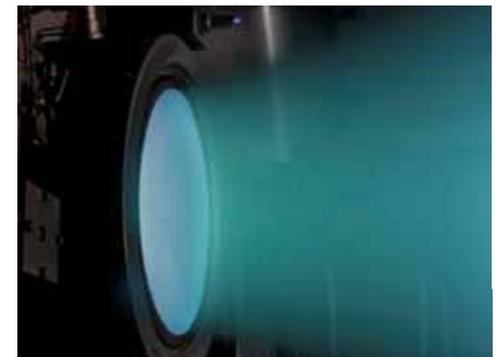
DART Program Update



- DART mission confirmed by NASA in August, 2018. DART is in PHASE C-D
- NASA has re-affirmed decision to use NEXT-C ion propulsion system for DART
- NASA will procure launch services for DART through NLS; LV selection is in process
 - DART will have dedicated LV
- LICIA Cube, an ASI-contributed cubesat
 - Letters exchanged between NASA and ASI
 - Studying operations concept and cubesat accommodations on DART



Autonomous navigation using imager to guide to target



NEXT-C ion propulsion first flight





DART Ion Propulsion Mission

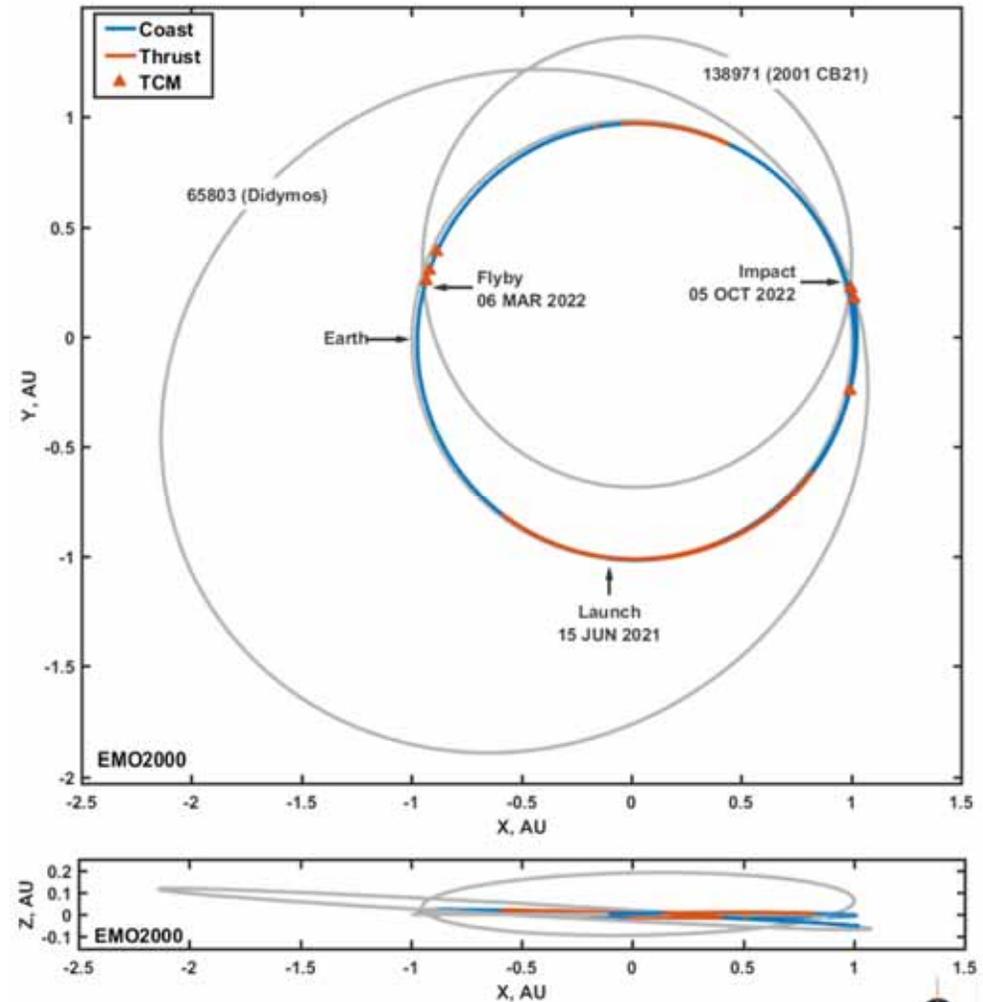
DART
Double Asteroid Redirection Test

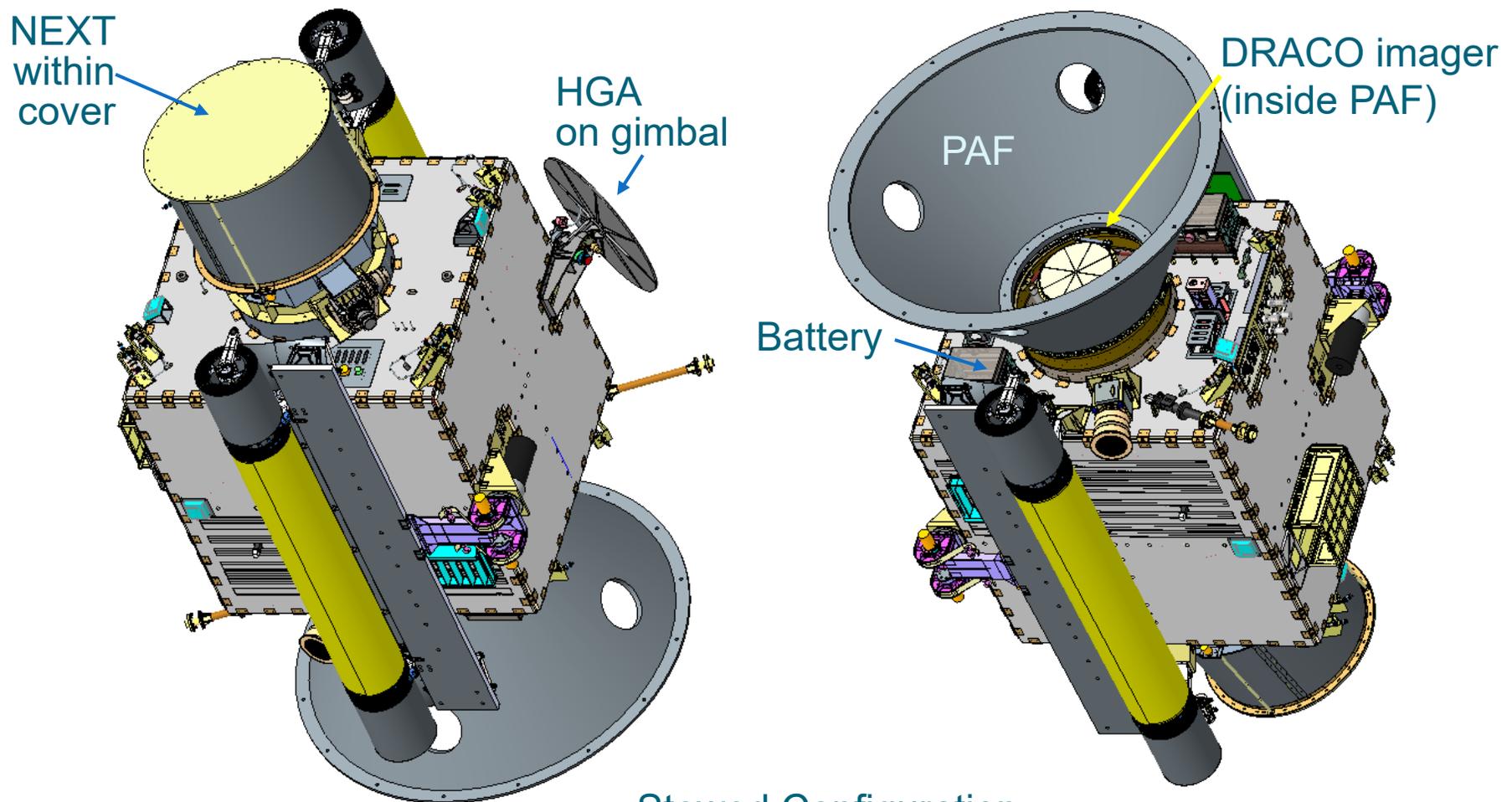
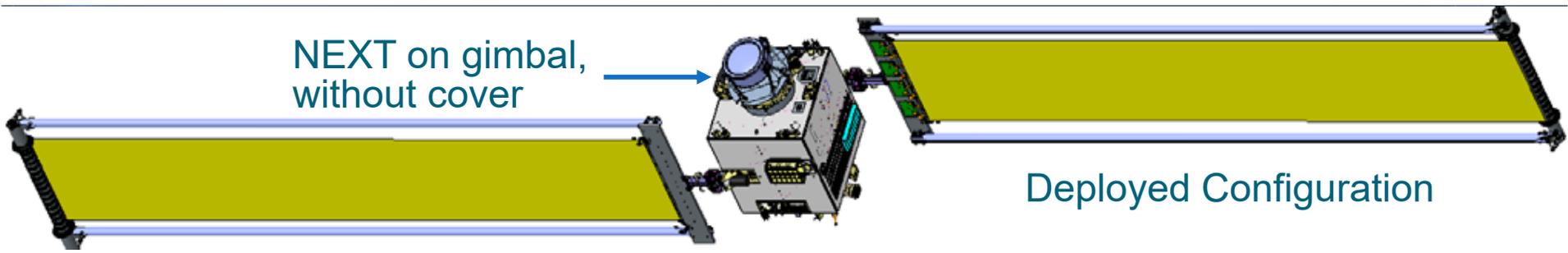
First flight of NASA NEXT-C ion engine

- **Launch Period Open:**
15 Jun 2021
- **2001 CB21 Flyby:**
06 Mar 2022
- **Didymos Impact:**
05 Oct 2022

Didymos Impact Conditions

DART Impact Speed	5.975 km/s
DART Mass at Impact	558 kg
Impact angle to orbit velocity*	164.185°
Impact angle to orbit plane**	15.803°
Solar phase angle	60.05°
*approximately opposite to orbit velocity	
**from Didymos southern hemisphere	





Stowed Configuration

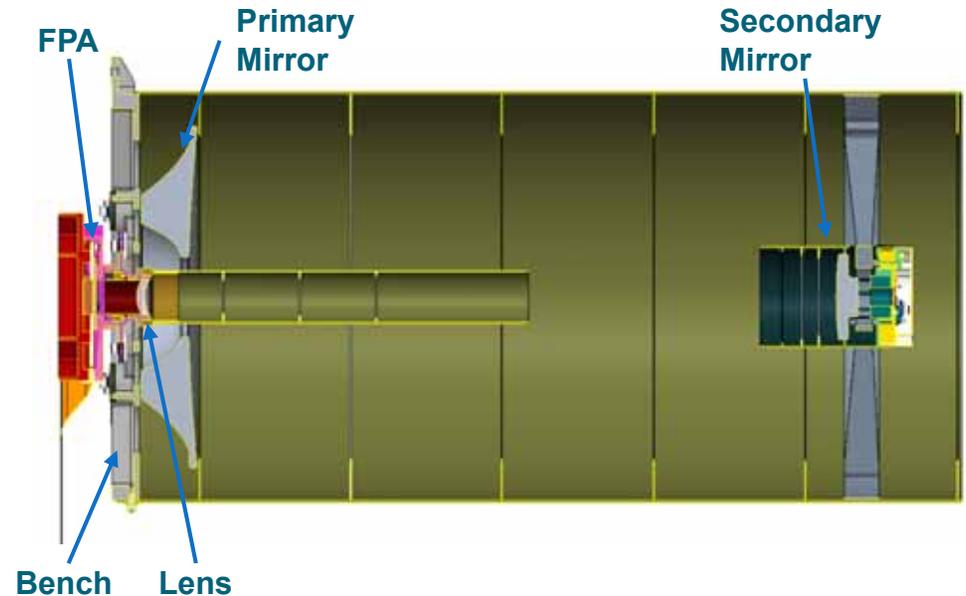


DRACO Imager



Panchromatic Visible Narrow-Angle Camera

DRACO Summary	
Aperture	208 mm
f/	12.6
FOV	0.29° × 0.29°
Telescope	Ritchey-Chretien with field-flattening lens, composite-Zerodur
Passband	400 nm - 1000 nm
Detector array	BAE CIS2521F sCMOS
Detector characteristics	Front side illuminated, rolling/global shutter, 2560 × 2160 format, 6.5 μm pixel pitch
SNR (30 days out)	>7
SNR (final)	>100



- DRACO acquires images at 0.5 m/px by 17 sec before impact, 2x2 binned images
- Characterize boulders and surface features of 1 m size
- Locate impact site to within 1 m

DRACO is based on New Horizons LORRI

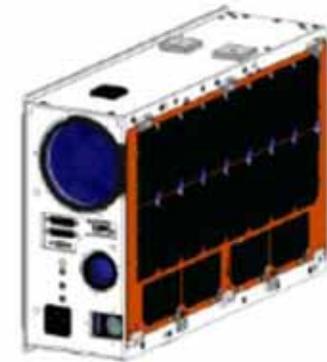




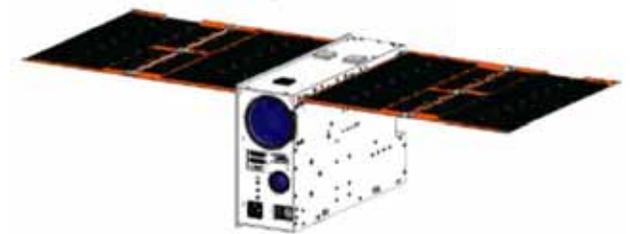
LICIA Cube: ASI cubesat for DART



- LICIA Cube based on the ArgoMoon 6U cubesat for the NASA EM-1 mission
- ArgoMoon has dual imaging systems, propulsive capability, onboard imaging processing and target recognition
- LICIA Cube carried by DART until close to Didymos and then released to perform a flyby of Didymos after DART impact
 - LICIA Cube images impact ejecta
- LICIA Cube downlinks images direct to Earth after the Didymos flyby



ArgoMoon stowed configuration



ArgoMoon deployed configuration



LICIA Cube: Science Objectives



- **Multiple (at least 3) images of the ejecta plume taken over a span of time and phase angle, that, with reasonable expectations concerning the ejecta mass and particle size distribution, can potentially**
 - **Allow measurement of the motion of the slow (< 5 m/s) ejecta**
 - **Allow estimation of the density structure of the plume**
- **Multiple (at least 3) images of the DART impact site having sufficient resolution (< 1 m/pixel) to allow measurements of the size and morphology of the crater; and taken sufficiently late after impact that the plume can be reasonably expected to have cleared**
- **Multiple (at least 3) images of Didymos B showing the non-impact hemisphere, that can potentially increase the accuracy of the shape and volume determination**



DART Team Meeting – please come



DART Spring 2019 Investigation Team Meeting

28 April 2019

College Park, Maryland, USA



*A one-day meeting, the Sunday before
the 6th IAA Planetary Defense
Conference, at the same venue:*

The Hotel at the University of Maryland

<http://dart.jhuapl.edu/Events/2019-Team-Meeting/>

