National Aeronautics and Space Administration

Impact of the Double Asteroid Redirection Test (DART)

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Planetary Defense Coordination Office

The Planetary Defense Coordination Office (PDCO) was established in January 2016 at NASA HQ to manage planetary defense related activities across NASA, and coordinate with both U.S. interagency and international efforts to study and plan response to the asteroid impact hazard.

Mission Statement

Lead national and international efforts to:

- Detect any potential for significant impact of planet Earth by natural objects
- Appraise the range of potential effects by any possible impact
- Develop strategies to mitigate impact effects on human welfare

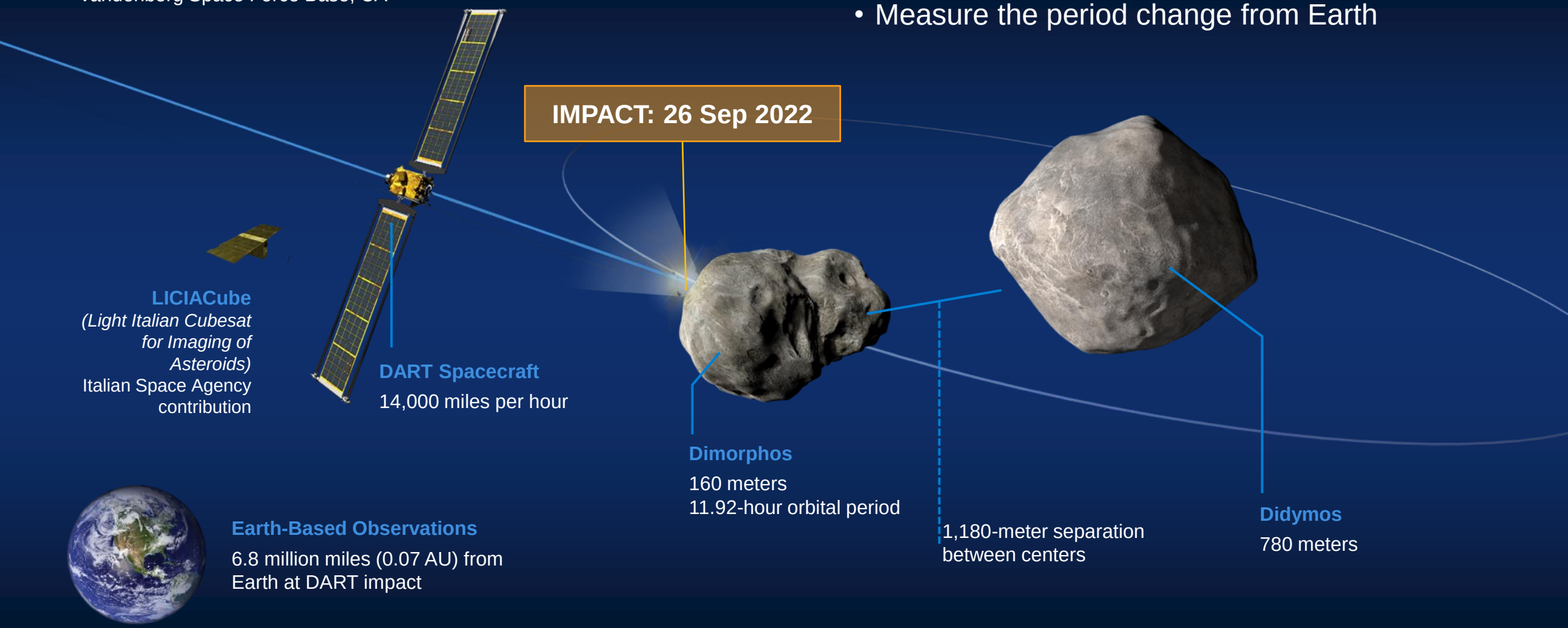

ASSESS
[CENTER FOR NEAR EARTH OBJECT STUDIES]
IAU
Minor Planet Center
SEARCH, DETECT & TRACK
[SPACE-BASED & GROUND-BASED OBSERVATIONS, IAWN]
PLANETARY
DEFENSE
MITIGATE
[DART, FEMA EXERCISES]
CHARACTERIZE
[NEOWISE, GOLDSTONE, IRTF]
PLAN &
COORDINATE
[SMPAG, PIERWG, NITEP IWG]

Launched on Nov. 24 EST

SpaceX Falcon 9
Vandenberg Space Force Base, CA

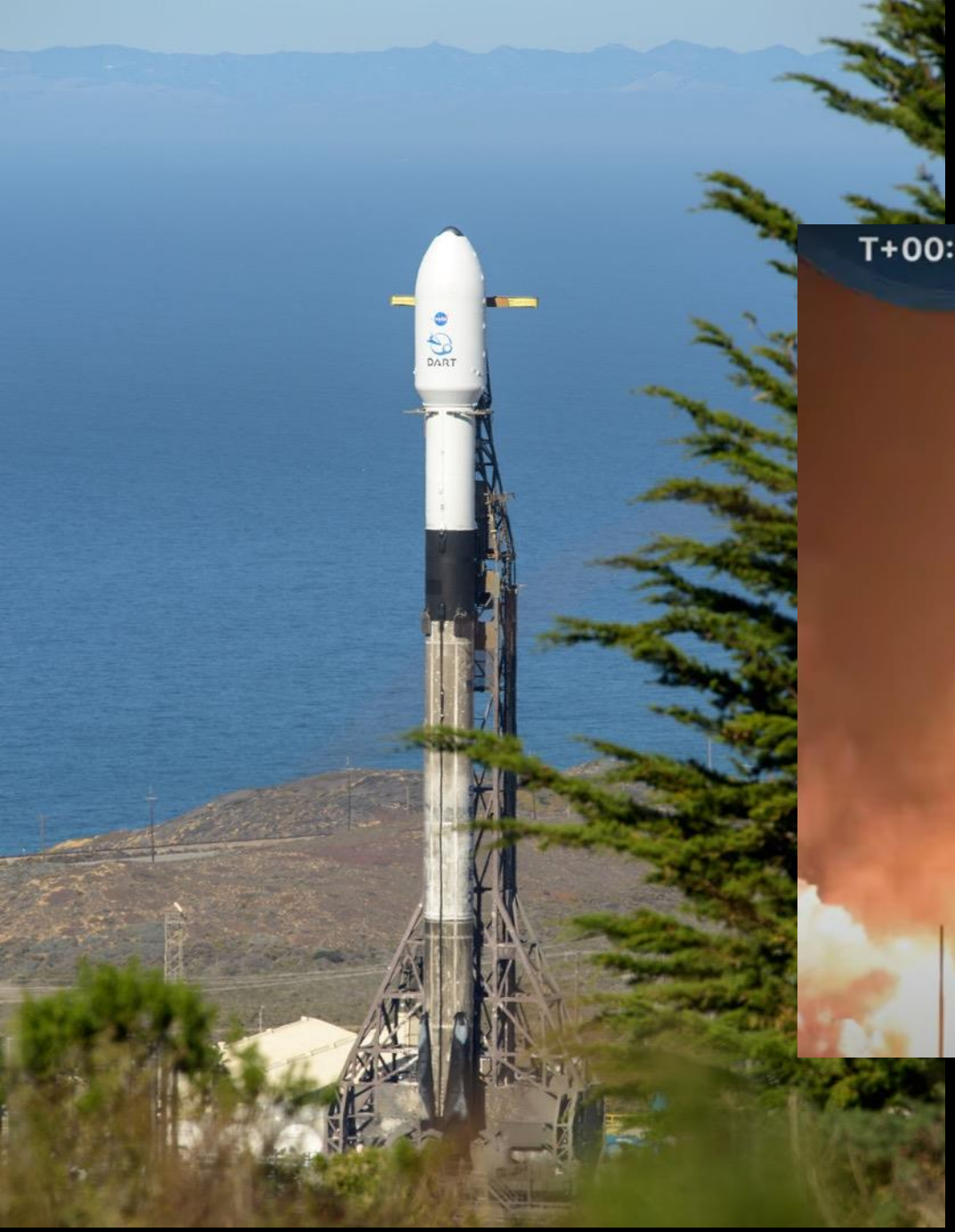
DART Mission:

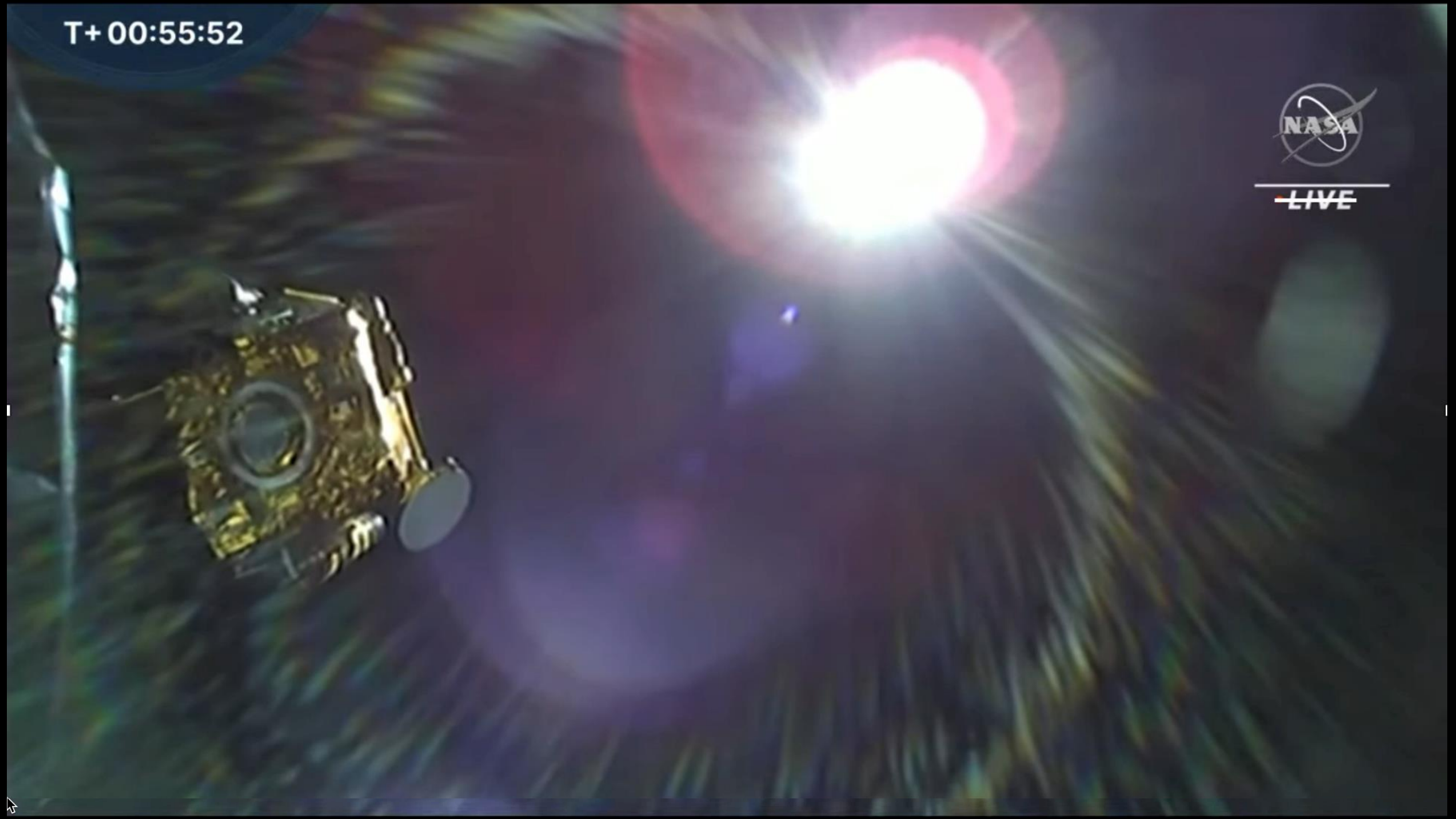
- Target the binary asteroid Didymos system
- Impact Dimorphos and change its orbital period
- Measure the period change from Earth



DART in launch vehicle fairing at Space X processing facility

DART Launch – November 23, 2021 PST (Nov. 24 EST)
Vandenberg Space Force Base, California

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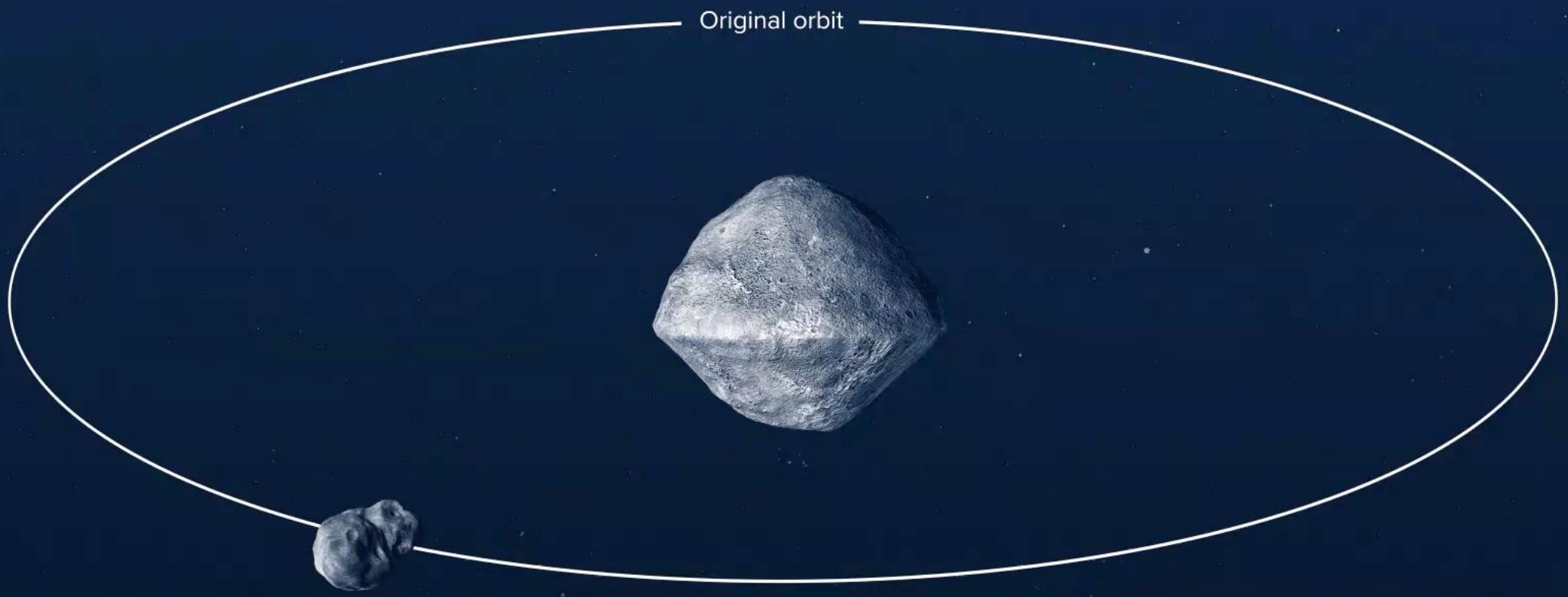
NASA
LIVE

DART

Double Asteroid Redirection Test

It allows a deflection demonstration on an asteroid of the relevant size by changing its orbital period by **~1%** about the larger asteroid.



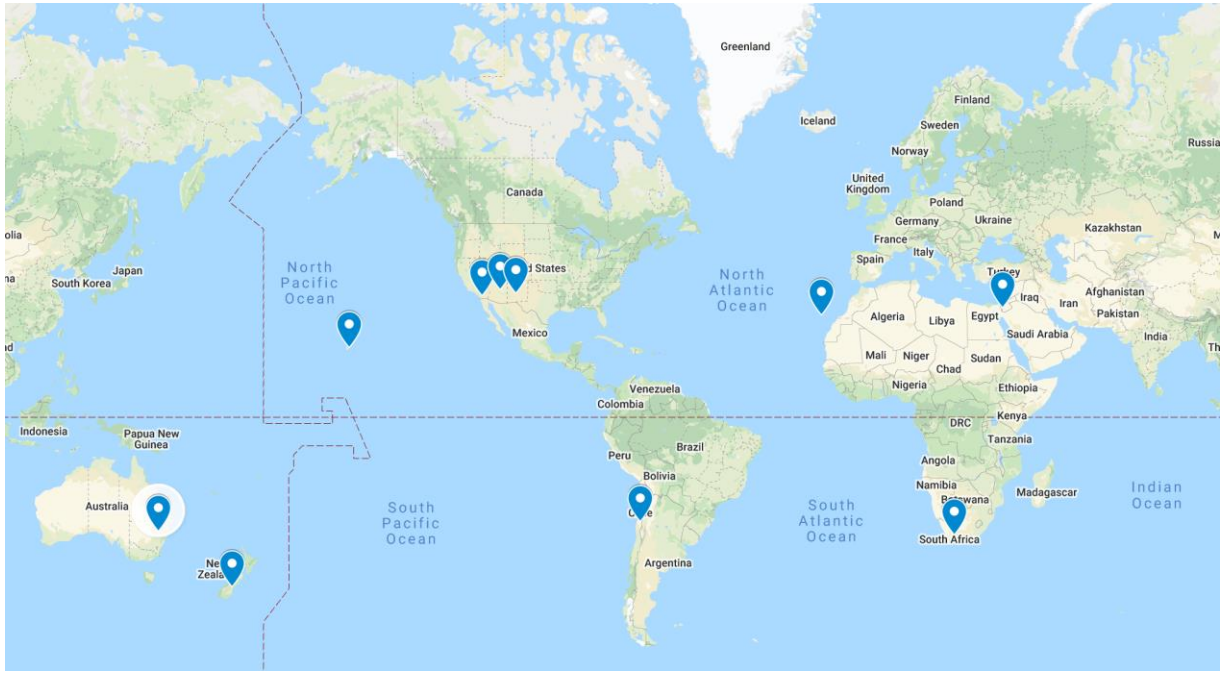
Earth-based observations

Plan for Pre-Impact and Post-Impact Observations

- Plan will begin observations during 22 Jun—6 July 2022 dark time, end during 15—28 March 2023 dark time

1. Contracted Observatories to obtain required data
   - Lowell Observatory
   - Magdalena Ridge Observatory
   - Las Cumbres Global Observatory Network
   - Las Campanas Observatory
2. Competed time already successfully in hand
   - JWST, HST, Goldstone planetary radar
3. To-be competed time via proposals
   - US and non-US facilities
4. Telescopes operated by team members
   - Mt. John (New Zealand), a few others

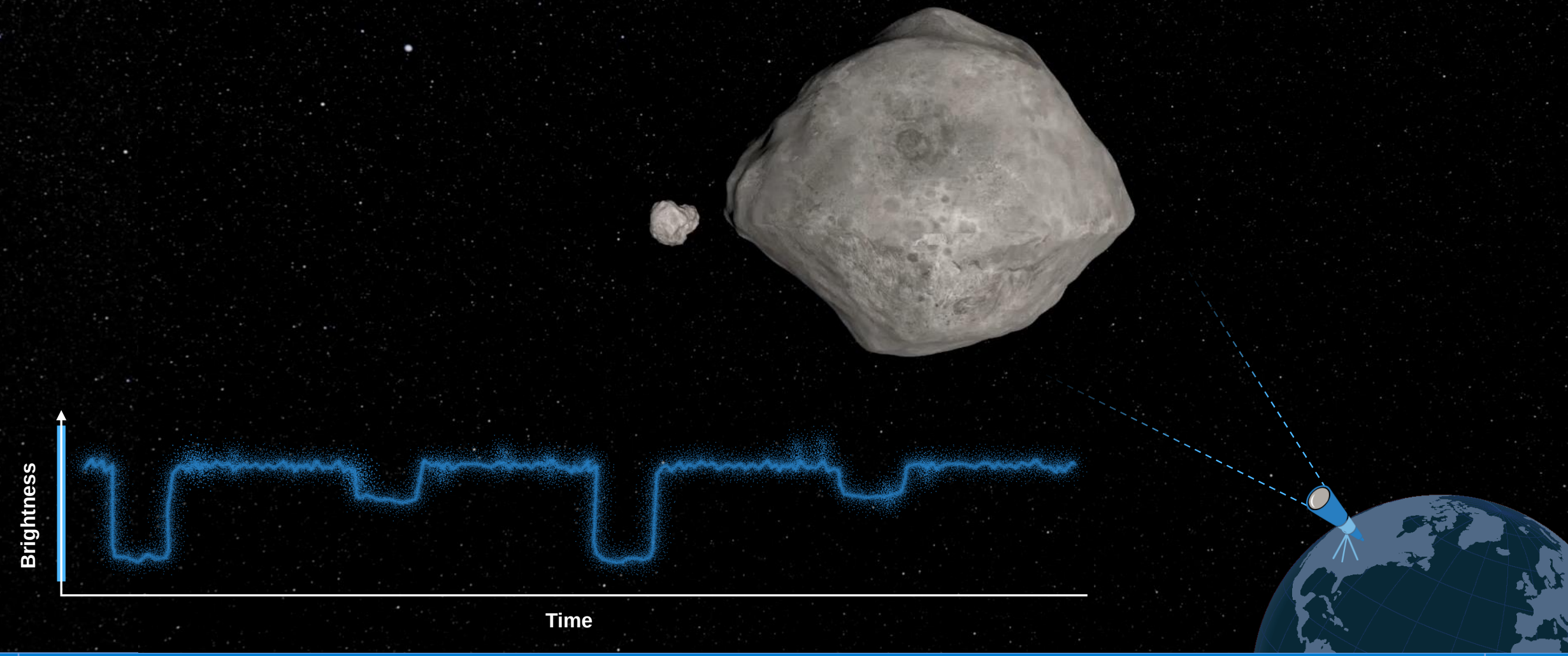
- Observatory schedules typically not formally set until a few weeks prior to observations, but planning to observe near new moon each month



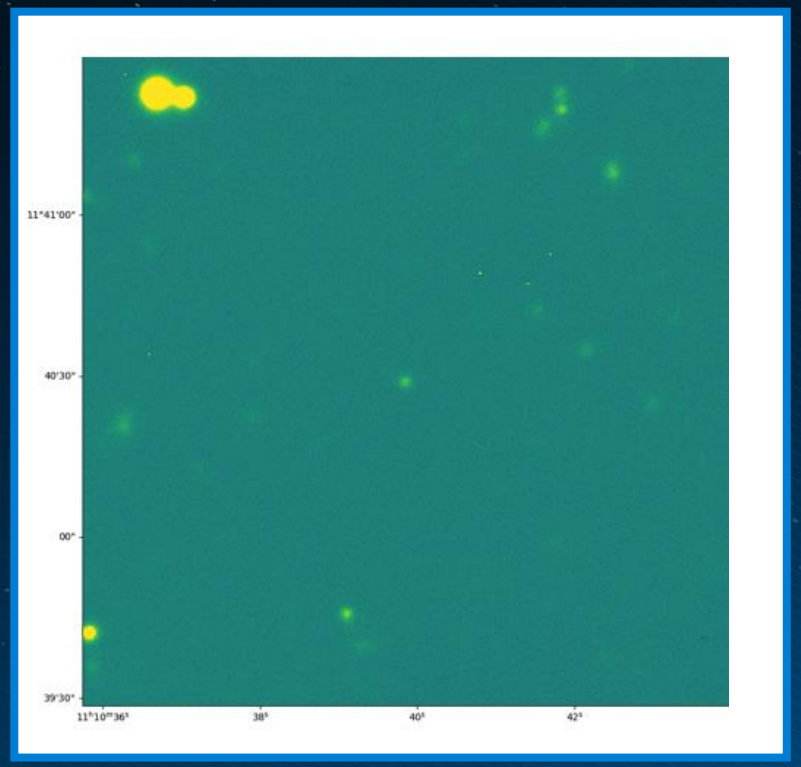
Sites of contracted/participating ground-based telescopes

Combined Observation plans provide assurance that required data will be obtained

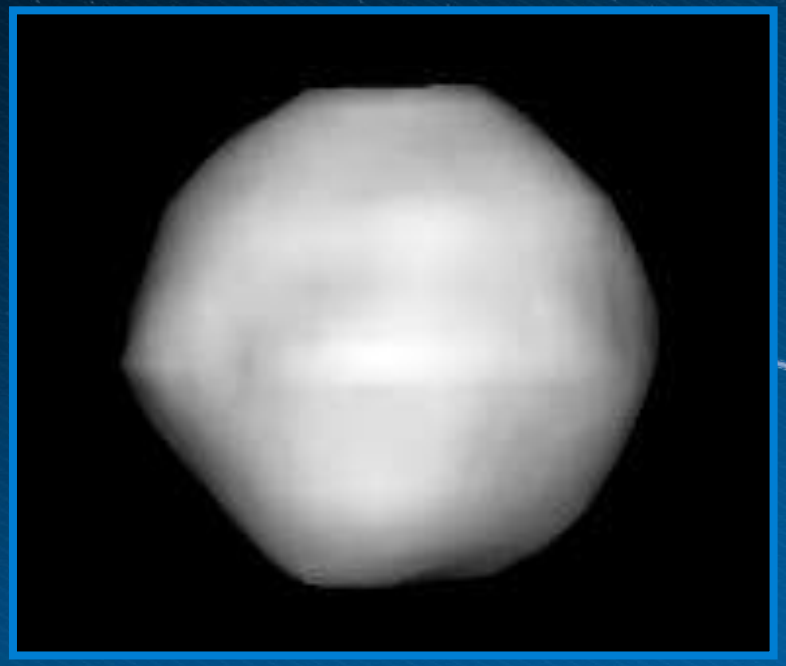
Measuring result of the impact from Earth: new orbit for Dimorphos

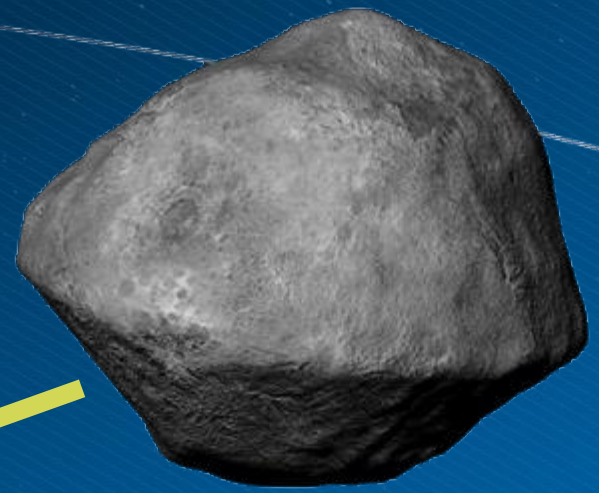


Know only the primary asteroid's size and shape



Images centered on Didymos, moving through star fields
Taken from VLT in Chile, March/April 2019

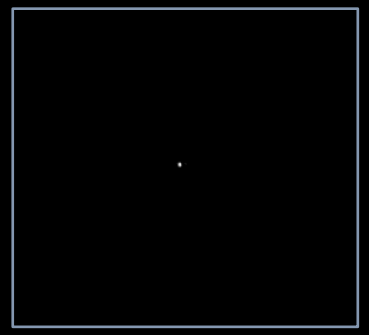




Radar shape model

Preliminary shape model of the Didymos primary asteroid from combined radar and light curve data, Diameter ~780 m.

Know little about the moon before time to hit it!



24,000 kilometers
Didymos – 6.5 pixel
Dimorphos – 1.4 pixel
Target becomes observable

60 minutes

1600 kilometers
Didymos – 99 pixel
Dimorphos – 21 pixel
Final divert maneuver corrections

4 minutes

800 kilometers
Didymos – 197 pixel
Dimorphos – 41 pixel
Divert maneuvers complete, cruise to impact

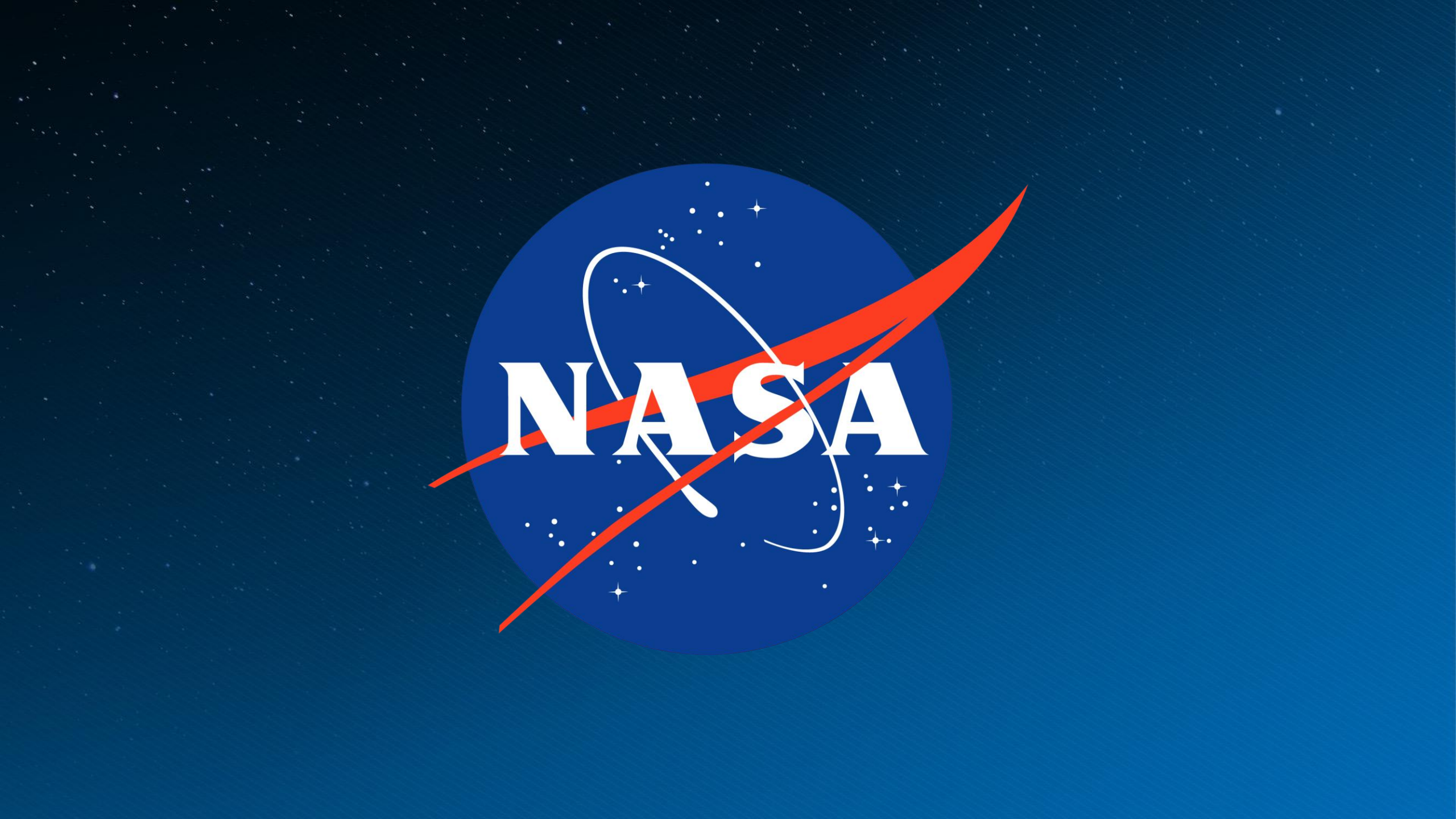
2 minutes

130 kilometers
Didymos – N/A
Dimorphos – ~300 pixel
Pixel-scale requirements met

20 seconds

30 days | 10 days | 8 hours | 4 hours | **60 minutes** | **4 minutes** | **2 minutes** | **20 seconds**

Impact - September 26, 2022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