Proximity Observations by the Didymos Reconnaissance and Asteroid Camera for OpNav (DRACO)

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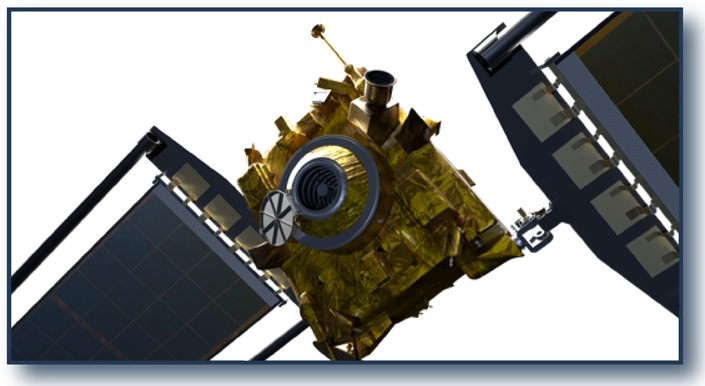


The Didymos Reconnaissance and Asteroid Camera for OpNav (DRACO) is a narrow field-of-view imager on NASA's Double Asteroid Redirection Test (DART) spacecraft. DART is a planetary defense mission that will perform the first kinetic impactor demonstration by impacting Dimorphos, the secondary asteroid in the binary 65803 Didymos system in September 2022.

DRACO is designed to support optical navigation of the spacecraft and ensure impact with the secondary member of the Didymos system, to refine system properties (e.g., orbit, rotation rate, pole), to characterize the surface characteristics and shape of the Didymos secondary during the terminal phase, and to constrain the location of the impact site.

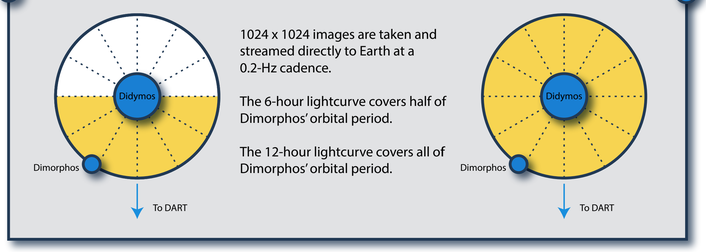
Timeline of proximity operations for the final 30 days before impact

T-30 days
DRACO detects Didymos system

T-15 days
6-hour lightcurve observation

T-3 days
12-hour lightcurve observation

OpNavs
Observations to support optical navigation will be acquired every five hours throughout most of this period, and more frequently in the final days.



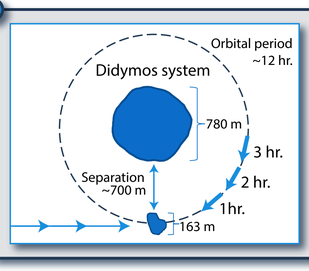
1024 x 1024 images are taken and streamed directly to Earth at a 0.2-Hz cadence.

The 6-hour lightcurve covers half of Dimorphos' orbital period.

The 12-hour lightcurve covers all of Dimorphos' orbital period.

Simulated images assume a 6.6 km/s impact velocity. Because impact velocity depends upon the launch date, the time at which these pixel scales are met could shift by 1–2 seconds in either direction. Scaled shape models of Ryugu and Itokawa were used as stand-ins for Didymos and Dimorphos, respectively.

T-4 hours
Terminal Phase begins

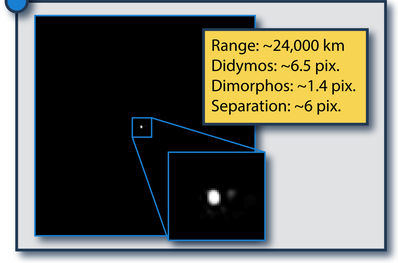


Range: ~96,000 km
Didymos: ~2 pix.
Dimorphos: unresolved
Separation: unresolved

Four hours before impact, SMART Nav guidance is enabled.

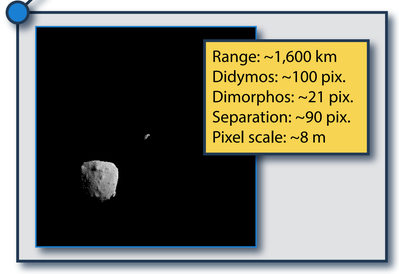
512 x 512 DRACO images are taken and streamed directly to Earth at a 1-Hz cadence from this point until impact.

T-1 hour
SMART Nav targets Dimorphos

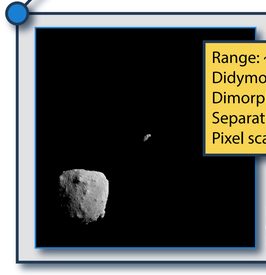


Range: ~24,000 km
Didymos: ~6.5 pix.
Dimorphos: ~1.4 pix.
Separation: ~6 pix.

T-4 minutes
Final Phase begins



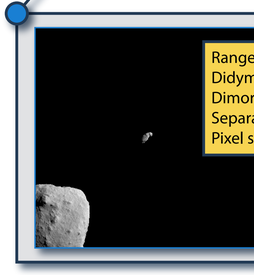
Range: ~1,600 km
Didymos: ~100 pix.
Dimorphos: ~21 pix.
Separation: ~90 pix.
Pixel scale: ~8 m



Range: ~1,200 km
Didymos: ~150 pix.
Dimorphos: ~32 pix.
Separation: ~120 pix.
Pixel scale: ~6 m

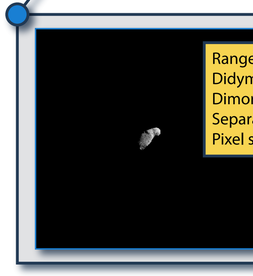
Final images to contain all of Didymos

T-2 minutes
SMART Nav maneuvers complete



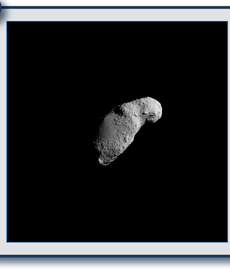
Range: ~800 km
Didymos: ~200 pix.
Dimorphos: ~42 pix.
Separation: ~180 pix.
Pixel scale: ~4 m

Final images to contain any of Didymos



Range: ~400 km
Didymos: n/a
Dimorphos: ~84 pix.
Separation: n/a
Pixel scale: ~2 m

T-20 seconds
DRACO achieves required 66-cm pixel scale



Range: ~130 km
Didymos: n/a
Dimorphos: ~250 pix.
Separation: n/a
Pixel scale: ~66 cm

Higher resolution images will continue to be acquired and downlinked in the final seconds of the mission.