

Rendezvous Mission to Apophis for Scientific Investigation and Planetary Defense: Pre-phase A Study



April 13 2029
31,600 km



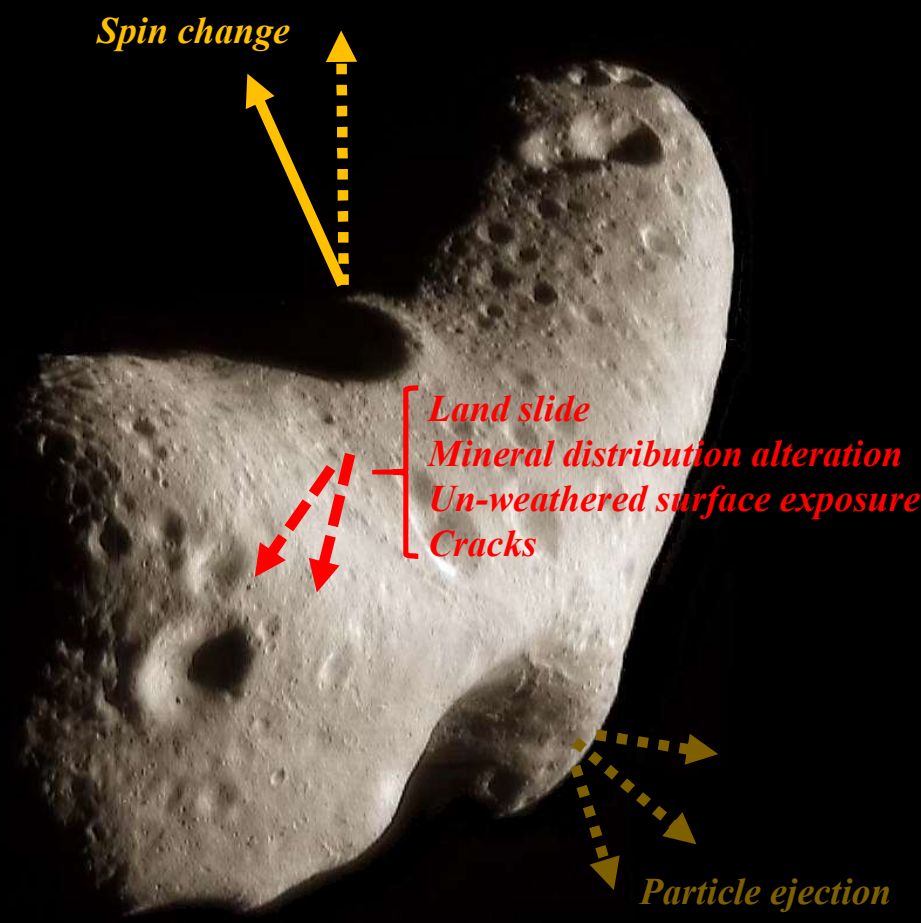
**H.-K. Moon¹, Y.-J. Choi¹, M.-J. Kim¹, M. Jeong¹, J. Choi¹, JeongAhn¹, H. Yang¹, H-J Lee¹, M. Ishiguro²,
S.-M. Baek¹, C. K. Sim¹, D. Lee¹, S.-Y. Park³, P. Kim³ and RMA collaborations**

¹ Korea Astronomy and Space Science Institute (KASI)

² Seoul National University

³ Yonsei University

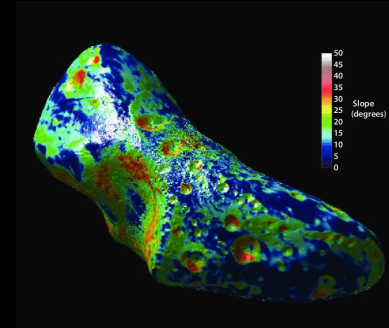
Rendezvous Mission to Apophis: Science topics



Global

Surface

Ejection

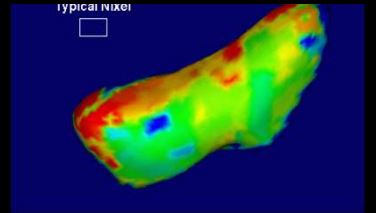
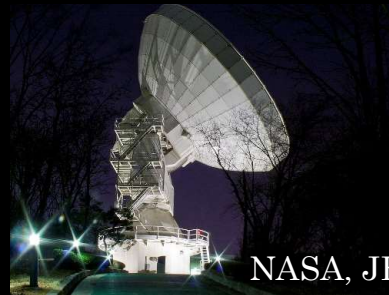


shape and topographic deformations
spin change

distribution of minerals, relative regolith size,
degree of space weathering, surface roughness,
collisional evolution, signs of hydration,
exogenous material

material movement,
mineral distribution alterations,
un-weathered surface exposure

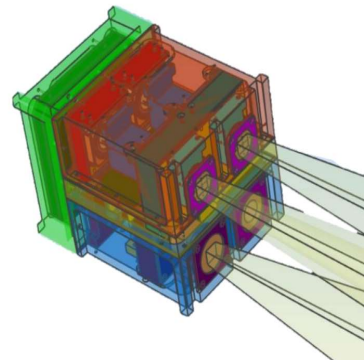
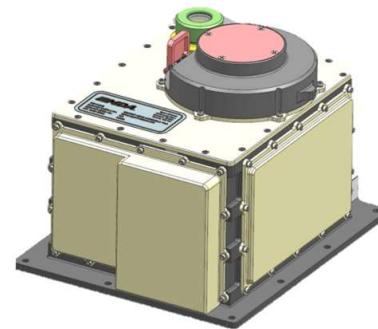
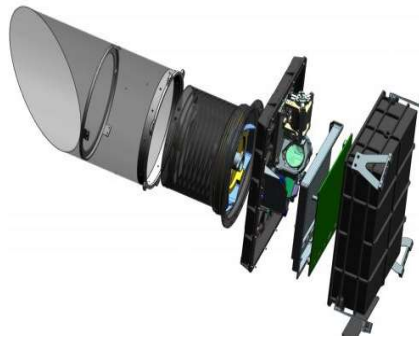
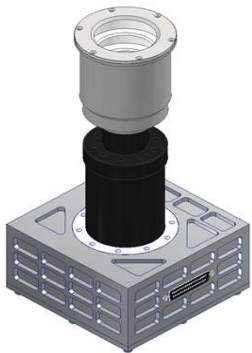
source regions, particle size distribution,
particle velocities, particle compositions,
ejection mechanisms



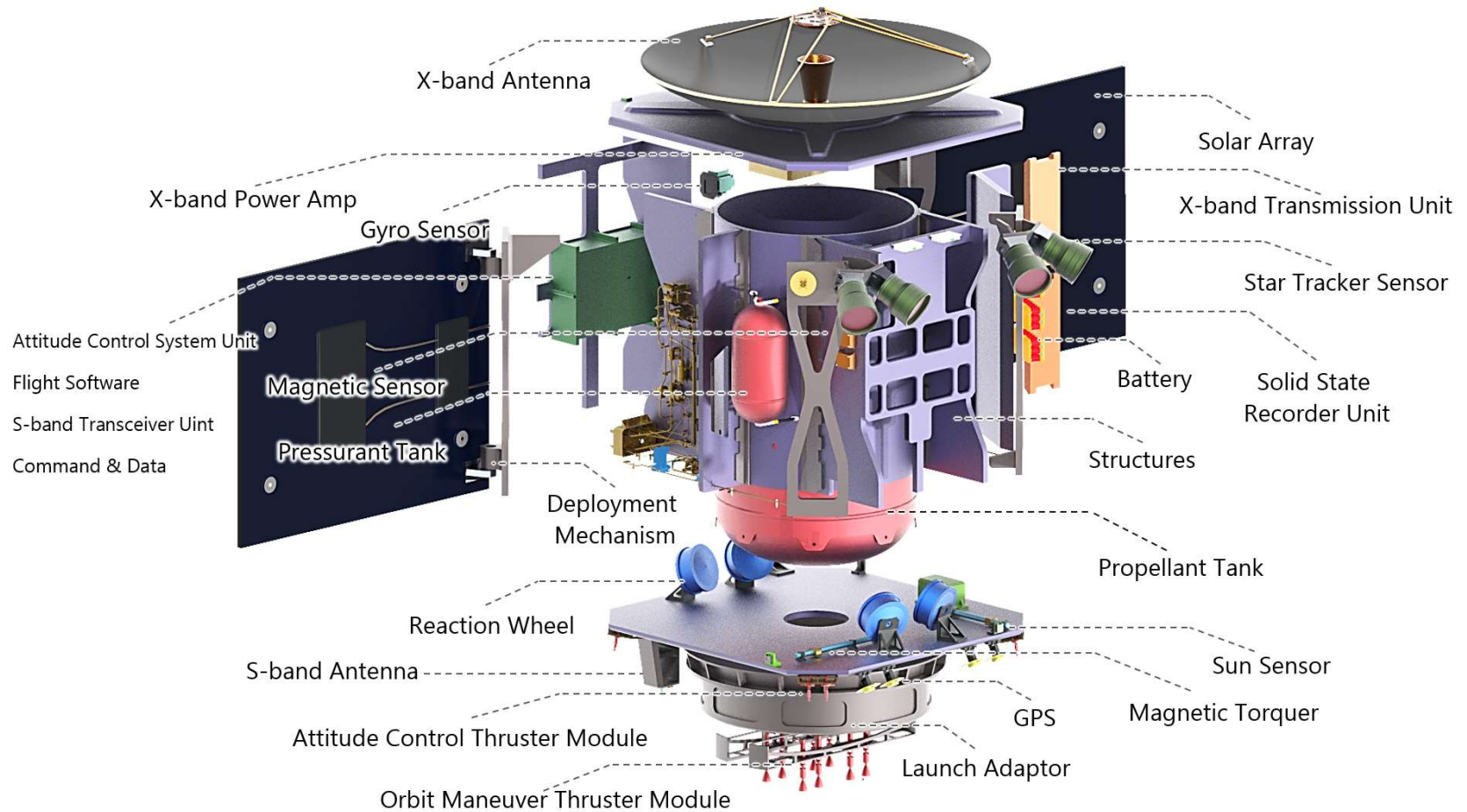
NASA, JHU, USGS, Asphaug+02, KASI

Rendezvous Mission to Apophis: Candidate science payloads

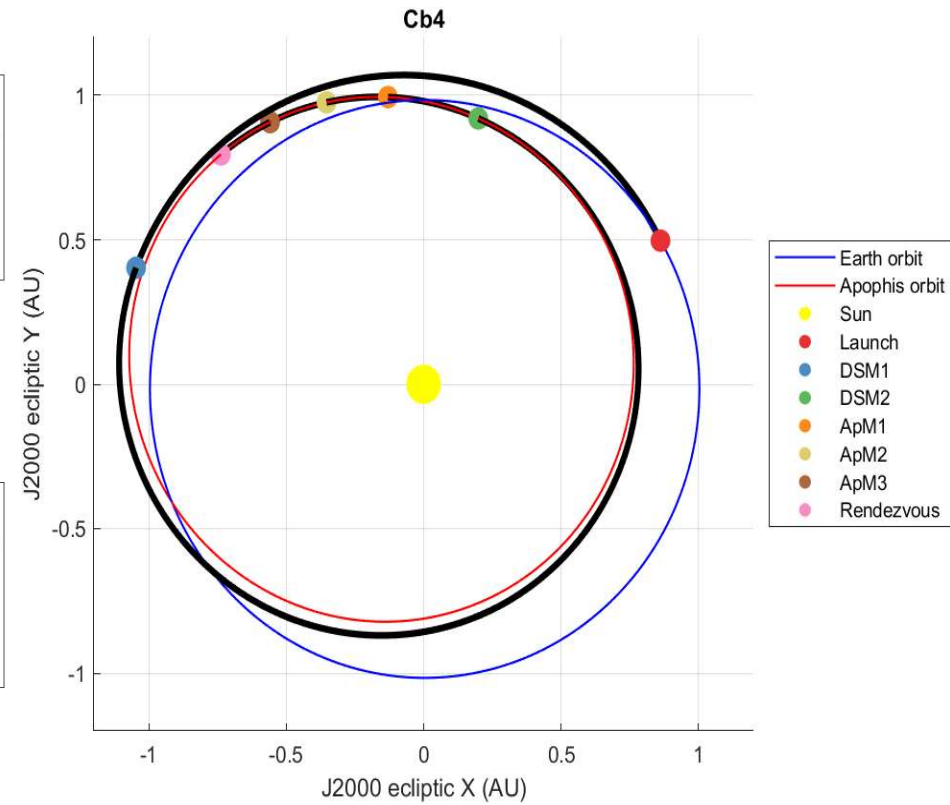
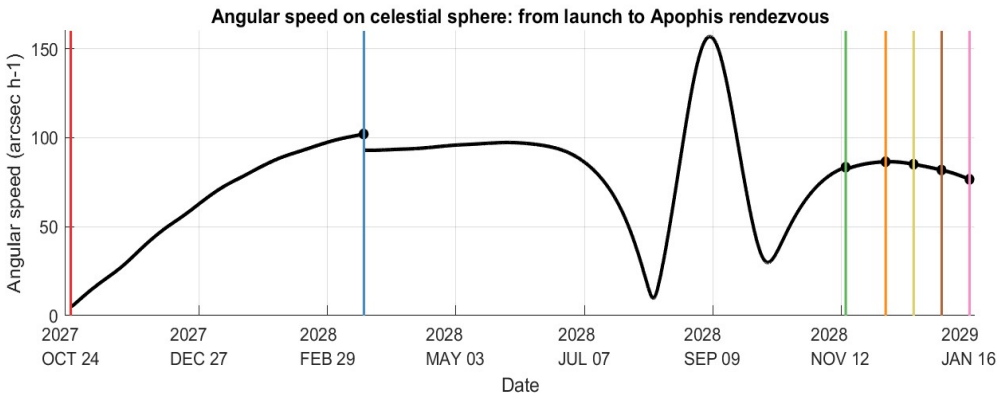
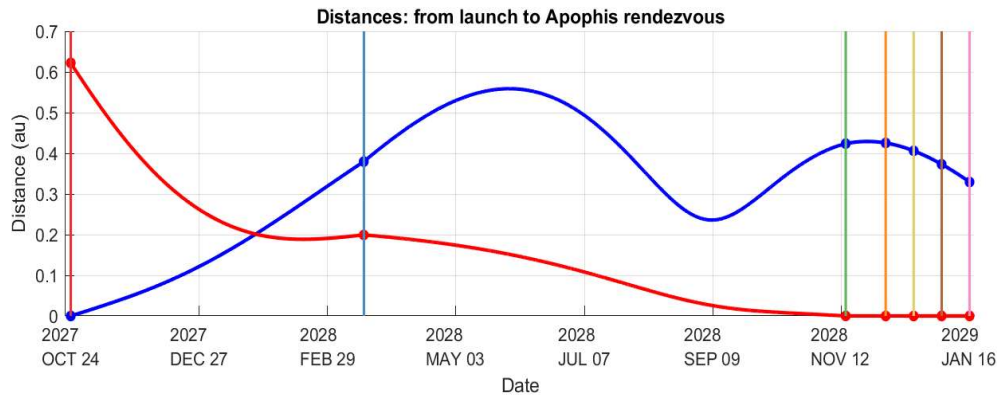
payload	mass (kg)	max power (W)	volume (mm)	notes
Wide-angle camera	3	10	200 x 150 x 150	FOV 60°x60°
Polarimetric camera	4	15	300 x 150 x 150	< 0.25 m/pixel @ 10 km, P_err: < 1 %p
Laser altimeter	3.5	17	230 x 200 x 200	Si APD detector, ND:YAG laser
Imaging spectrograph	< 1	10	128 x 96 x 100	HERA/ASPECT, 850-1650 nm
...
Total budget	40	38 W, max	-	c.f.) operation scenario



Rendezvous Mission to Apophis: Spacecraft



Rendezvous Mission to Apophis: Trajectory design



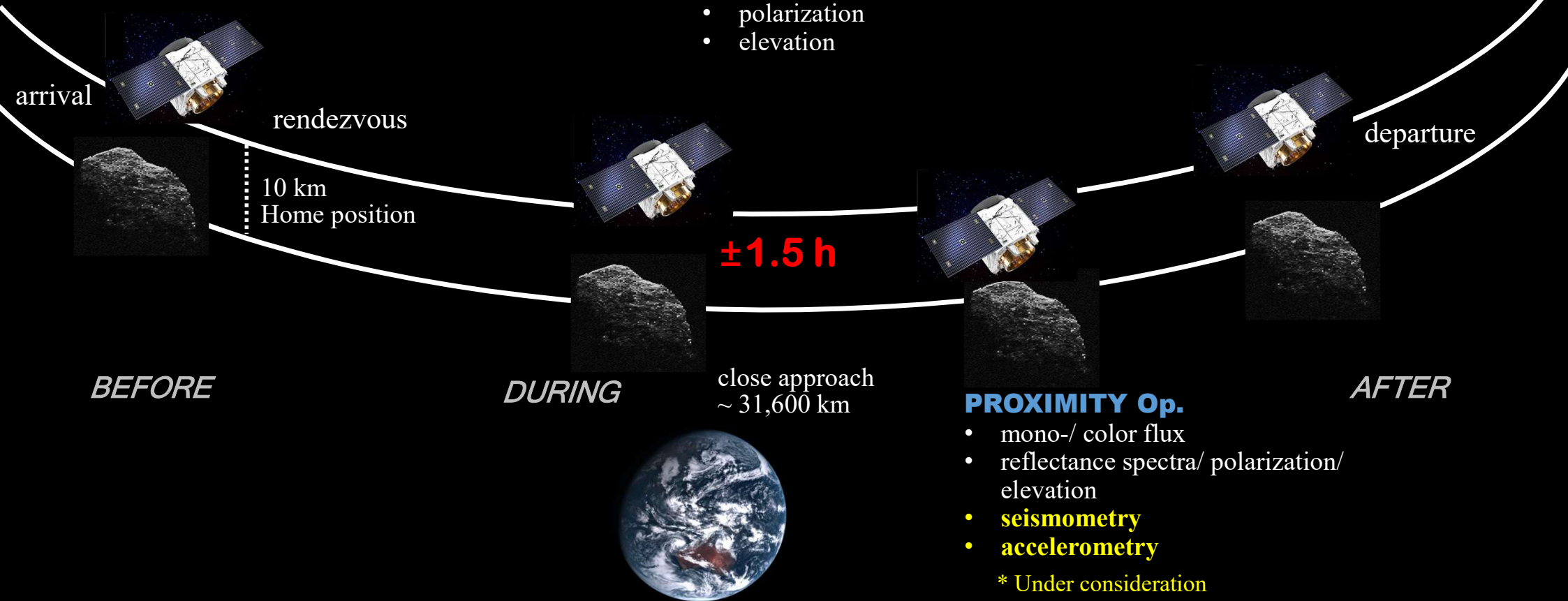
Rendezvous Mission to Apophis: Mission scenario

D-90 PRE-MAPPING

D=0 MAPPING

D+90 RE-MAPPING

- monochromatic flux
- color/ reflectance spectra
- polarization
- elevation



Rendezvous Mission to Apophis: Milestones and collaboration opportunities

- We found the **launch windows** in **mid-2027-mid-2028** is the most realistic and energy-efficient opportunities to arrive the target **before Earth encounter**.
- One of our current options for the launcher is to use the KSLV (Korea Space Launch Vehicle) series rocket in development.
- Our tentative plan is **1) to design** (2022-24), **2) to build, integrate, and test** (2025-27), **3) to launch** (2027-2028), and **to perform 4) science operations** (2028-2030) with universities, research institutes, and companies in Korea.
- However, it is opened to overseas institutes **for joint scientific studies and operations**.