A Mobile Asteroid Surface Scout (MASCOT) on board the Hayabusa 2 Mission to the near Earth asteroid (162173) Ryugu

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MASCOT is part of JAXA's Hayabusa 2 asteroid sample return mission that has been launched to asteroid (162173) Ryugu (1,2,3) on Dec 3rd, 2014. It is scheduled to arrive at Ryugu in 2018, and return samples to Earth in 2020. The German Aerospace Center (DLR) developed the lander MASCOT with contributions from CNES (France) (2,3). Ryugu has been classified as a Cg-type (4), believed to be a primitive, volatile-rich remnant from the early solar system. Its visible geometric albedo is 0.07, its diameter 0.87 km (5). The thermal inertia indicates thick dust with a cm-sized, gravel-dominated surface layer (5,6). Ryugu shows a retrograde rotation with a period of 7.63 h. Spectral observations indicate iron-bearing phyllosilicates (1) on parts of the surface, suggesting compositional heterogeneity. MASCOT will enable to in-situ map the asteroid's geomorphology, the intimate structure, texture and composition of the regolith (dust, soil and rocks), and its thermal, mechanical, and magnetic properties in order to provide ground truth for the orbiter remote measurements, support the selection of sampling sites, and provide context information for the returned samples (2,3). MASCOT comprises a payload of four scientific instruments: a camera, a radiometer, a magnetometer and a hyperspectral microscope (2,3,7,8). Characterizing the properties of asteroid regolith in-situ will deliver important ground truth for further understanding telescopic and orbital observations as well as samples of asteroids. MASCOT will descend and land on the asteroid and will change its position by hopping (3). This enables measurements during descent, at the touch-down positions, and during hopping. The first order scientific objectives for MASCOT are to investigate at least at one position: the geological context of the surface by descent imaging and far field in-situ imaging; the global magnetization by magnetic field measurements during descent and any local magnetization at the landing positions; the mineralogical composition and physical properties of the surface and near-surface material including minerals, organics and the detection of possible, near–surface ices; the surface thermal environment by measuring the asteroids surface temperature over the entire expected temperature range for a full day-night cycle; the regolith thermophysical properties by determining the surface emissivity and surface thermal inertia; the local morphology and in-situ structure and texture of the regolith including the rock size distribution and small-scale particle size distribution; the context of the observations performed by both, the instruments onboard the main spacecraft and the in situ measurements performed by MASCOT ('cooperative observations'). Provide documentation and context of the samples and correlate the local context of the in situ analysis with the remotely sensed global data; the body constitution on local and/or global scales and constrain surface and possibly sub-surface physical properties; the context of the sample collected and returned by the main spacecraft by qualifying its generic value and processed/pristine state and thus support the laboratory analyses by indicating potential alteration during sampling, cruise, atmospheric

entry and impact phases.

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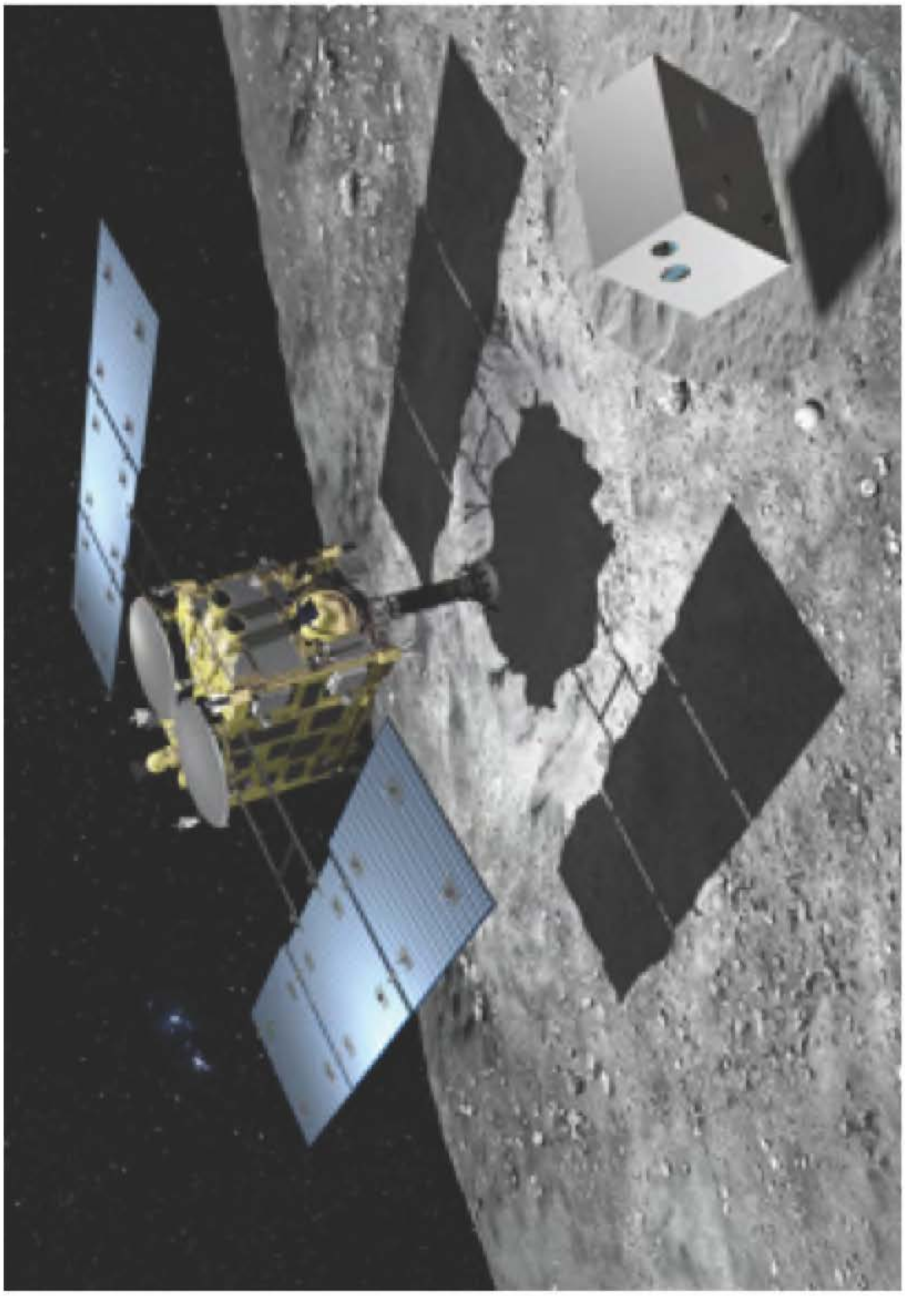

Artist's conception of HY-2 during sampling, also showing MASCOT landed on the surface.
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