

SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (5)

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MISSION CONCEPT FOR ROBOTIC EXPLORATION OF DEIMOS

Abstract

Mars' moons Deimos and Phobos, the only known satellites of a terrestrial planet other than our Moon, remain poorly understood. Despite many missions to Mars, the moons have seen only hours of spacecraft attention. Their compositions and place in the history of the Martian system remain a mystery. Only by studying the moons in situ or with returned samples can we uncover information they record about the early solar system, and resolving whether Deimos and Phobos are remnants of Mars' formation, samples of Mars' interior ejected by giant impacts, or captured primitive objects that record samples of volatiles and organics that accreted onto Mars early in the planet's history. The Russian GRUNT mission, launching in 2011-2012, will conduct in situ studies of Phobos and return samples to Earth to determine the moon's origin. A Discovery-class mission concept described in this paper will obtain the complementary in situ measurements from Deimos. The scientific objectives of the mission are to determine Deimos elemental and mineralogical composition, volatile and organic content, and characterize processes that have modified its surface. To achieve these objectives, a landed payload provides stereo imaging and measurements of elemental and mineralogical composition. An orbital payload, to acquire global high-resolution and color imaging and to measure Deimos' shape, will put the landing site in context by characterizing Deimos geology. The spacecraft, launching in 2017 on Atlas 401, would perform MOI in 2020. Flying in formation with Deimos, the spacecraft would use small changes in orbit around Mars to provide "pseudo-orbits" around Deimos that cover a range of altitudes and illuminations over 2.5 months. Data taken during 1- to 2- km altitude flyovers would certify the landing site. The spacecraft, delivered to a point several km above Deimos, would navigate to landing within 300 m of a target using onboard imaging, investigating a fresh exposure of regolith. A 60-day baseline operations period will provide a complete set of landed measurements from a single location.