

Statement of Objective

Map the global properties, chemistry, and mineralogy of a primitive carbonaceous asteroid to characterize its geologic and dynamic history and provide context for the returned samples

Overview

OSIRIS-REx provides insight into the geologic and dynamic history of Bennu. According to the current paradigm of asteroid dynamics, Bennu formed in the inner main asteroid belt, where many B-type objects currently reside.

Its parent body was a primitive asteroid that formed ~4.5 billion years ago. A collision shattered this parent body. Bennu then migrated due to the Yarkovsky effect into a dynamical resonance capable of placing it into an Earth-crossing

orbit. This history is recorded in the shape, surface texture, spectral properties, mass, rotation state, and composition of Bennu. OSIRIS-REx will thoroughly map the global properties, chemistry, and mineralogy of Bennu and develop global-

scale knowledge of Bennu at a spatial resolution that provides a well-defined context for the returned samples.

Level-1 Requirements

1.6 – Produce a shape model of Bennu with 1-m lateral and vertical resolution

1.7 – Determine the surface slopes, accelerations and geopotential of Bennu at 1-m spatial resolution

1.8 – Determine the bulk density of Bennu to within 1%, determine up to the fourth degree and order gravity harmonic coefficients, and search for and characterize any density inhomogeneities within the asteroid

1.9 – Measure the number, sizes, spatial distribution, and morphologies of possible craters and boulders, regolith distributions, and search for evidence of surface expression of internal structure on Bennu

1.10 – Resolve key mineralogical and organic features with spectral absorptions $\geq 5\%$ to detect the following species: adsorbed water, phyllosilicates, carbonates, sulfates, silicates, oxides, and hydrocarbons, and determine mineral, organic, and phase abundances on the surface of Bennu, at a global spatial resolution of 50 m or better

1.11 – Search for and spectrally and visually characterize regions of active volatile outgassing from the surface of Bennu

1.12 – Search for and spectrally and visually characterize satellites in orbit around Bennu

1.13 – Search for and characterize the effects of space-weathering on Bennu