Hera: Multiple Near-Earth Asteroid Sample Return

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Abstract

With the discovery of large numbers of Near-Earth Asteroids and the successful Deep Space 1 and Shoemaker NEAR missions, multiple sample return from NEA is now technically feasible. We have designed a mission to take three samples from three NEA and return them to Earth. The mission is named Hera, after the mother of the Three Graces. The target asteroids will be chosen on the basis of their spectra and the sampling sites will be chosen from orbit. Sufficient material will be returned for all qualified investigators to obtain samples. One trajectory identified to date is a follows. Hera would be launched on 15 Jan 2006 by a Boeing Delta 7925-10 and reach asteroids AO10 on 3 Aug 2006, 2000 AG6 on 10 Nov 2006, and 1989 UQ on 7 Mar 2009. Stay periods would be 99 days, 98 days and 205 days, respectively. Hera would return the samples to Earth on 13 Nov 2010 using Stardust procedures. Hera is equipped with gallium arsenide solar panels capable of producing 6 kWe, and three ion thrusters similar to those on Deep Space 1 (for deep space) and hydrazine thrusters (for asteroid operations). Hera's dryweight is 650 kg, and the fuel weight is 350 kg Xe and 60 kg hydrazine. The sampling device is an auger bit on a universal coupling housed inside a conical collector. The device is deployed without landing the spacecraft. Nine independent compartments house the samples for return. The amount and quality of science data produced by Hera will be higher than any mission since Apollo. The depth and breadth of analysis on Earth far exceeds that possible by in situ methods and samples can be archived for future research. Furthermore, seven of the eleven goals in the NASA Strategic Plan for Space Science can be uniquely addressed by Hera and the samples it returns. These involve a variety of fundamental planetary science issues, mitigation of impact effects, HEDS and resource utilization.