

Near-Earth Asteroid Sample Return - A Community Panel Report for the NRC Decadal Study.

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Abstract

A recent LPI workshop (summarized at the 32nd LPSC and AIAA Space 2001 meetings) addressed the scientific and engineering issues of NEA sample return. Participants of the workshop, and others, constitute the panel. The astronomical study of asteroids and the laboratory study of meteorites contribute considerably to the issues identified in the NASA Space Science Strategic Plan by providing unique insights into the origin, evolution and chronology of the solar system, presolar materials, the origin and survival of life on Earth, and solar activity and the space environment. These studies have reached a point where asteroid sample return is scientifically essential. Returned samples would be from known geological context (crater, crater rim, crater ejecta, intercrater plains, regolith, bedrock, ponds, etc.) on known asteroid type, would include new primitive materials too weak to survive atmospheric passage, and would provide ground truth for interpreting astronomical spectra. The samples could be subjected to a depth and breadth of study not available by robotic techniques, and they could be archived indefinitely pending future ideas and analytical techniques. The data would provide new insights for the interpretation of existing meteorite and asteroid data so there would be a net multiplying effect. In view of their number and diversity, sample return from multiple asteroids is required, but if the targets are well chosen and there is coordination with international partners, a scientifically rewarding first look would require sample return from as few as 3-5 asteroids. The success of the NEAR-Shoemaker and Deep Space 1 missions, and the rate of NEA discoveries, mean that NEA sample return is technically feasible with Discovery-type missions. Furthermore, robotic exploration of NEAs is a logical next step for NASA's solar system exploration program, being intermediate between the Moon and Mars in complexity, and such missions will have popular and governmental interest.