

Human and Robotic Exploration of Near-Earth Objects

A study in late 2006 was sponsored by the Advanced Projects Office within NASA's Constellation Program to examine the feasibility of sending the Orion Crew Exploration Vehicle to a near-Earth object (NEO). The ideal mission profile would involve two or three astronauts on a 90 to 180 day flight, which would include a 7 to 14 day stay for proximity operations at the target NEO. More recently U.S. President Obama stated on April 15, 2010 that the next goal for human spaceflight will be to send human beings to a near-Earth asteroid by 2025. Given this direction from the White House, NASA has been involved in studying various strategies for NEO exploration in order to follow U.S. space exploration policy. Prior to sending a human mission, a series of robotic spacecraft would be launched to reduce the risk to crew, and enhance the planning for the proximity and surface operations at the NEO. The human mission would ideally follow five or more years later.

This mission would be the first human expedition to an interplanetary body beyond the Earth-Moon system and would prove useful for testing technologies required for human missions to Mars and other solar system destinations. Piloted missions to NEOs would undoubtedly provide a great deal of technical and engineering data on spacecraft operations for future human space exploration while conducting in-depth scientific investigations of these primitive objects. The main scientific advantage of sending piloted missions to NEOs would be the flexibility of the crew to perform tasks and to adapt to situations in real time. A crewed vehicle would be able to test several different sample collection techniques and target specific areas of interest via extra-vehicular activities (EVAs) more efficiently than robotic spacecraft. Such capabilities greatly enhance the scientific return from these missions to NEOs, destinations vital to understanding the evolution and thermal histories of primitive bodies during the formation of the early solar system. Data collected from these missions would help constrain the suite of materials possibly delivered to the early Earth, and would identify potential source regions from which NEOs originate. In addition, the resulting scientific investigations would refine designs for future extraterrestrial resource extraction and utilization, and assist in the development of hazard mitigation techniques for planetary defense.