14th HUMAN EXPLORATION OF THE MOON AND MARS SYMPOSIUM (A5)
Going beyond the Earth-Moon system: Human Missions to Mars, Libration points, and NEO's (4)

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ENTERING THE INTERPLANETARY GATEWAY: SHORT-DURATION HUMAN MISSIONS TO NEAR-EARTH OBJECTS

Abstract

Human exploration of near-Earth asteroids (NEAs) offers valuable and exciting opportunities as stepping stones to eventual Mars exploration and colonization. A stepping-stone approach (similar to that seen in the *Apollo* program during the *Moon Race*) not only reduces the overall risk and complexity of a human space exploration program, but also reduces the wait-time needed for the next "new" mission, allowing the public to lend its crucial support to the program much earlier than would otherwise be anticipated without intermediate exploration achievements. Fortunately, asteroids have recently been given serious consideration as human exploration targets, especially by NASA, as evidenced by the White House's summary of NASA's FY2012 budget request, which highlights "a mission to an asteroid next decade".

The most accessible asteroids for human exploration are NEAs that pass relatively close to the Earth. The most energy-favorable NEA rendezvous missions generally require mission durations of 180 to 365 days (or more) when applying modern-day chemical propulsion system technology constraints. However, significant gaps exist between these NEA missions and lunar missions, especially with regard to mission duration, energy requirements and abort options. To gradually fill these mission-driving gaps, humans can gain invaluable experience and confidence by embarking on shorter duration and less complex NEA missions. Such missions are divided into three mission classes that allow for various exploration "firsts" for humans on their way through the interplanetary gateway to asteroids, Mars and beyond.

The first two mission classes consist of NEA flyby missions while the third class consists of NEA rendezvous missions. Within these classes, near-term opportunities to near-Earth comets (NECs) also exist, but to date only in the second class. The first class contains inside-sphere-of-influence (ISOI) NEA flyby missions, with mission durations of about 10 to 50 days. These missions allow humans to travel within Earth's SOI, yet farther than lunar distance for the first time. The second class contains outside-sphere-of-influence (OSOI) NEA and NEC flyby missions, with mission durations of about 50 to 120 days. These missions allow humans to escape Earth's SOI and venture into interplanetary space for the first time. Finally, the third class allows humans to rendezvous with a NEA in interplanetary space for the

first time by embarking on OSOI NEA rendezvous missions containing mission durations of about 50 to 180 days.

Near-term feasible mission opportunities within these three mission classes were determined after considering all known near-Earth objects. Details will be presented.