Next Gen NEAR: Near Earth Asteroid Human Robotic Precursor Mission Concept

Andrew S. Rivkin*, Karen Kirby, Andrew F. Cheng, Robert Gold, Daniel Kelly, Cheryl Reed
The Johns Hopkins University Applied Physics Laboratory, Laurel, MD
**e-mail: andrew.rivkin@jhuapl.edu*

Paul Abell
NASA Johnson Space Center, Houston TX

James Garvin and Rob Landis**
NASA Goddard Space Flight Center, Greenbelt, MD
***Also at Wallops Flight Facility, Wallops Island, VA*

Asteroids have long held the attention of the planetary science community. In particular, asteroids that evolve into orbits near that of Earth, called near-Earth objects (NEO), are of high interest as potential targets for exploration due to the relative ease (in terms of delta V) to reach them. NASA's Flexible Path calls for missions and experiments to be conducted as intermediate steps towards the eventual goal of human exploration of Mars; piloted missions to NEOs are such example. A human NEO mission is a valuable exploratory step beyond the Earth-Moon system enhancing capabilities that surpass our current experience, while also developing infrastructure for future mars exploration capabilities. To prepare for a human rendezvous with an NEO, NASA is interested in pursuing a responsible program of robotic NEO precursor missions. Next Gen NEAR is such a mission, building on the NEAR Shoemaker mission experience at the JHU/APL Space Department, to provide an affordable, low risk solution with quick data return. Next Gen NEAR proposes to make measurements needed for human exploration to asteroids: to demonstrate proximity operations, to quantify hazards for human exploration and to characterize an environment at a near-Earth asteroid representative of those that may be future human destinations.

The Johns Hopkins University Applied Physics Laboratory has demonstrated exploration-driven mission feasibility by developing a versatile spacecraft design concept using conventional technologies that satisfies a set of science, exploration and mission objectives defined by a concept development team in the summer of 2010. We will describe the mission concept and spacecraft architecture in detail. Configuration options were compared with the mission goals and objectives in order to select the spacecraft design concept that provides the lowest cost, lowest implementation risk, simplest operation and the most benefit for the mission implementation.

The Next Gen NEAR spacecraft was designed to support rendezvous with a range of candidate asteroid targets and could easily be launched with one of several NASA launch vehicles. The Falcon 9 launch vehicle supports a Next Gen NEAR launch to target many near-Earth asteroids under consideration that could be reached with a C3 of 18 km^2/sec^2 or less, and the Atlas V-401 provides added capability supporting launch to NEAs that require more lift capacity while at the same time providing such excess lift capability that another payload of opportunity could be launch in conjunction with Next Gen NEAR.

Next Gen NEAR will measure and interact with the target surface in ways never undertaken at an asteroid, and will prepare for first human precursor mission by demonstrating exploration science operations at an accessible NEO. This flexible mission and spacecraft design concept supports target selection based on upcoming Earth-based observations and also provides opportunities for co-manifest & international partnerships. JHU/APL has demonstrated low cost, low risk, high impact missions and this mission will help to prepare NASA for human NEO exploration by combining the best of NASA's human and robotic exploration capabilities.