LOW-COST RELOCATABLE LUNAR POLAR LANDER AND LUNAR SURFACE SAMPLE RETURN

ABSTRACT FOR THE INTERNATIONAL PLANETARY PROBE WORKSHOP 2010

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ABSTRACT

Key objectives of lunar robotic precursor missions can be achieved with the Lunar Explorer (LEx) low cost robotic landing mission concept and a sample return version of the mission called BOOMERANG The LEx mission would land a small re-locatable lander within the lunar south polar region to evaluate distribution of volatiles, dust, il-lumination, geologic context, and local hazards in both sunlit and permanently shadowed environments. Improved assessment and understanding of lunar polar region cold-trap reservoir characteristics, geophysics, and potential resources will have direct impact on future robotic and human exploration architecture decisions. LEx represents a highly-focused pathfinder, exploring both sunlit and shadowed sites in the lunar south polar region to provide essential ground-truth for understanding resources and for linking surface observations with those from orbital remote-sensing.

The mission is designed to be co-manifested as a secondary payload on any future lunar mission allowing further cost savings and programmatic flexibility. Upon landing within a sunlit south polar region, LEx will perform independent, specific, and quantitative measurements of the lunar regolith. The LEx mission continues with a new mobility approach that enables a multi-kilometer, powered flight to a nearby permanently shadowed site where a full suite of measurements will be repeated. This provides first-ever access to a permanently shadowed region and a “ground-truth” dataset for environmental characterization, potential resources assays, local hazards, as well as validating an innovative near-surface mobility approach. Additional LEx lander flight systems can be acquired at a fraction of their initial cost to serve as an asset in precursor robotic missions. The low cost, globally targetable, mobile, precision-landed robotic access to the Moon that can be provided by LEx has significant potential to reduce risk and cost of future landed systems.

A similar approach and design was used in developing a NASA Discovery cost class lunar surface sample return concept (BOOMERANG). The proposed BOOMERANG landing region would be within the southern highlands where a simple vacuum sample acquisition system acquires a ~100g sample. The BOOMERANG lander/sample acquisition system would then lift off and deploy a sample canister capsule to low lunar orbit, which is then be captured by a simple spacecraft for rendezvous and Earth return and entry.. This mission can readily meet lunar precursor robotic mission goals, serve as a pathfinder for enabling future low-cost, risk-tolerant robotic missions and address high priority NRC Decadal Survey (Planetary), and NRC lunar science (SCEM 2007) goals.