International Strategy for the Exploration of Lunar Polar Volatiles. J. E. Gruener[1] and N. H. Suzuki[2], [1]NASA Johnson Space Center (Mail Code KX111, 2101 NASA Parkway, Houston, Texas, 77058, john.e.gruener@nasa.gov) [2]NASA Headquarters (Mail Code CQ000, 300 E Street Southwest, Washington, DC, 20546, nantel.h.suzuki@nasa.gov).

Introduction: The National Aeronautics and Space Administration (NASA) is participating in the International Space Exploration Coordination Group (ISECG), working together with 13 other space agencies to advance a long-range human space exploration strategy. The ISECG is a voluntary, non-binding international coordination mechanism through which individual agencies may exchange information regarding interests, objectives, and plans in space exploration with the goal of strengthening both individual exploration programs as well as the collective effort.

The ISECG has developed a Global Exploration Roadmap (GER) that reflects the coordinated international dialog and continued preparation for exploration beyond low-Earth orbit – beginning with the International Space Station (ISS) and continuing to the Moon, near-Earth asteroids, and Mars [1]. Space agencies agree that human space exploration will be most successful as an international endeavor, given the challenges of these missions. The roadmap demonstrates how initial capabilities can enable a variety of missions in the lunar vicinity, responding to individual and common goals and objectives, while contributing to building partnerships required for sustainable human space exploration that delivers value to the public.

Use of Local Resources: The initial capabilities and missions on the Moon will likely consist of small robotic missions limited in scale and mission duration, with everything needed for those missions delivered from Earth. However, when it comes to maintaining a longer-term human presence beyond low-Earth orbit, space agencies agree that the use of local resources would significantly benefit operations in the lunar vicinity, and limit the cost and complexity of bringing all the needed supplies from Earth. The most promising uses for local resource utilization are in life support systems or as propellants.

For many years, the lunar regolith was seen as the primary source for both oxygen (chemically bound in lunar minerals and glasses) and hydrogen (implanted into the regolith by the solar wind). However, recent discoveries of water on the Moon [2], particularly in polar regions, may lead to less complex methods to create life support consumables and propellants. To gain an understanding of whether lunar polar volatiles, such as water ice, could be used in a cost effective and safe manner, it is necessary to understand more about the nature and distribution of the volatiles and whether they could be processed cost effectively.

International Strategy: The ISECG has begun an effort to develop a coordinated international lunar polar volatile strategy that is technically feasible, yet programmatically implementable. The strategy would follow an incremental phased approach, beginning with robotic prospecting to understand the nature and distribution of the polar volatiles through measurements on the lunar surface, and followed by robotic in situ resource utilization demonstrations (ISRU) to understand whether potential resources could be extracted and processed economically and safely.

Core Elements: Currently, there are three initial core elements to this strategy. 1.) Common Lunar Region - build a consensus among the international community for a common "Region" on the lunar surface to be collectively explored by a variety of sequential, coordinated missions. The region would be larger than a landing site for a single mission, perhaps areas as large as several tens of kilometers in extent, and possibly including highly illuminated peaks and permanently shadowed areas. 2.) Low Entrance Barriers - facilitate participation by space agencies, commercial entities, and universities by deployment of surface or orbital infrastructure assets that provide productivity-enhancing utility services within the specified region (i.e., power generation, thermal protection, communication) to allow for simpler, lower cost rovers or other surface systems; and collaborative development of instrument or surface system capabilities between participants. 3.) Common Standards – utilize standard interfaces (mechanical, electrical, communication) and standard propellants to optimize use of surface utility services, permit interchangeability of vehicle payload complements, and maximize interoperability.

References: [1] ISECG (2013) *http://www.nasa.gov/sites/default/files/files/GER-2013_Small.pdf*. [2] Robinson K. L. and Taylor G. J. (2014) *Nature Geoscience, 7,* 401-408.